WAGO-I/O-SYSTEM 750

Modular I/O-System

Fieldbus Coupler PROFINET IO 750-370

Manual

Technical description,
installation and configuration

Version 1.1.1

WAGO INNOVATIVE CONNECTIONS

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Every conceivable measure has been taken to ensure the correctness and completeness of this documentation. However, as errors can never be fully excluded we would appreciate any information or ideas at any time.

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We wish to point out that the software and hardware terms as well as the trademarks of companies used and/or mentioned in the present manual are generally trademark or patent protected.

Table of Contents

1 Important Notes

This section includes an overall summary of the most important safety requirements and notes that are mentioned in each individual section. To protect your health and prevent damage to devices as well, it is imperative to read and carefully follow the safety guidelines.

1.1 Legal Bases

1.1.1 Copyright

WAGO Kontakttechnik GmbH & Co. KG reserves the right to provide for any alterations or modifications that serve to increase the efficiency of technical progress. WAGO Kontakttechnik GmbH & Co. KG owns all rights arising from the granting of patents or from the legal protection of utility patents. Third-party products are always mentioned without any reference to patent rights. Thus, the existence of such rights cannot be excluded.

1.1.2 Personnel Qualifications

The use of the product described in this Manual requires special personnel qualifications, as shown in the following table:

Activity	Electrical specialist	Instructed personnel*)	Specialists**) having qualifications in PLC programming
Assembly	X	X	
Commissioning	X		X
Programming			X
Maintenance	X	X	
Troubleshooting	X		
Disassembly	X	X	

*) Instructed persons have been trained by qualified personnel or electrical specialists.

**) A specialist is a person, who – thanks to technical training – has the qualification, knowledge and expertise to meet the required specifications of this work and to identify any potential hazardous situation in the above listed fields of activity.

All responsible persons have to familiarize themselves with the underlying legal standards to be applied. WAGO Kontakttechnik GmbH & Co. KG does not assume any liability whatsoever resulting from improper handling and damage incurred to both WAGO´s own and third-party products by disregarding detailed information in this Manual.

1.1.3 Use of the 750 Series in Compliance with Underlying Provisions

Couplers, controllers and I/O modules found in the modular WAGO-I/O-SYSTEM 750 receive digital and analog signals from sensors and transmit them to the actuators or higher-level control systems. Using programmable controllers, the signals can also be (pre-)processed.

The components have been developed for use in an environment that meets the IP20 protection class criteria. Protection against finger injury and solid impurities up to 12.5 mm diameter is assured; protection against water damage is not ensured. Unless otherwise specified, operation of the components in wet and dusty environments is prohibited.

1.1.4 Technical Condition of Specified Devices

The components to be supplied Ex Works, are equipped with hardware and software configurations, which meet the individual application requirements. Changes in hardware, software and firmware are permitted exclusively within the framework of the various alternatives that are documented in the specific manuals. WAGO Kontakttechnik GmbH & Co. KG will be exempted from any liability in case of changes in hardware or software as well as to non-compliant usage of components.

Please send your request for modified and new hardware or software configurations directly to WAGO Kontakttechnik GmbH & Co. KG.

1.2 Standards and Guidelines for Operating the 750 Series

Please adhere to the standards and guidelines required for the use of your system:

- The data and power lines shall be connected and installed in compliance with the standards required to avoid failures on your system and to substantially minimize any imminently hazardous situations resulting in personal injury.
- For assembly, start-up, maintenance and troubleshooting, adhere to the specific accident prevention provisions which apply to your system (e.g. BGV A 3, "Electrical Installations and Equipment").
- Emergency stop functions and equipment shall not be made ineffective. See relevant standards (e.g. DIN EN 418).
- The equipment of your system shall be conform to EMC guidelines so that any electromagnetic interferences will be eliminated.
- Operating 750 Series components in home applications without further measures is permitted only if they meet the emission limits (emissions of interference) in compliance with EN 61000-6-3. You will find the detailed information in section "WAGO-I/O-SYSTEM 750" → "System Description" → "Technical Data".
- Please observe the safety precautions against electrostatic discharge in accordance with DIN EN 61340-5-1/-3. When handling the modules, please ensure that environmental factors (persons, working place and packaging) are well grounded.
- The valid standards and guidelines applicable for the installation of switch cabinets shall be adhered to.

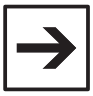
1.3 Symbols

Danger
Always observe this information to protect persons from injury.

Warning
Always observe this information to prevent damage to the device.

Attention
Marginal conditions that must always be observed to ensure smooth and efficient operation.

ESD (Electrostatic Discharge)
Warning of damage to the components through electrostatic discharge. Observe the precautionary measure for handling components at risk of electrostatic discharge.



Note
Make important notes that are to be complied with so that a trouble-free and efficient device operation can be guaranteed.

Additional Information
References to additional literature, manuals, data sheets and internet pages.

1.4 Safety Information

When connecting the device to your installation and during operation, the following safety notes must be observed:

Danger
The WAGO-I/O-SYSTEM 750 and its components are an open system. It must only be assembled in housings, cabinets or in electrical operation rooms. Access is only permitted via a key or tool to authorized qualified personnel.

Danger
All power sources to the device must always be switched off before carrying out any installation, repair or maintenance work.

Warning
Replace defective or damaged device/module (e.g. in the event of deformed contacts), as the functionality of field bus station in question can no longer be ensured on a long-term basis.

Warning
The components are not resistant against materials having seeping and insulating properties. Belonging to this group of materials is: e.g. aerosols, silicones, triglycerides (found in some hand creams). If it cannot be ruled out that these materials appear in the component environment, then the components must be installed in an enclosure that is resistant against the above mentioned materials. Clean tools and materials are generally required to operate the device/module.

Warning
Soiled contacts must be cleaned using oil-free compressed air or with ethyl alcohol and leather cloths.

Warning
Do not use contact sprays, which could possibly impair the functioning of the contact area.

Warning
Avoid reverse polarity of data and power lines, as this may damage the devices.

ESD (Electrostatic Discharge)
The devices are equipped with electronic components that may be destroyed by electrostatic discharge when touched.

Warning
For components with ETHERNET/RJ-45 connectors:
Only for use in LAN, not for connection to telecommunication circuits.

1.5 Font Conventions

italic	Names of paths and data files are marked in italic-type. e.g.: *C:\Programs\WAGO-IO-CHECK*
italic	Menu items are marked in italic-type, bold letters. e.g.: ***Save***
\	A backslash between two names characterizes the selection of a menu point from a menu. e.g.: ***File \ New***
END	Pushbuttons are marked as bold with small capitals e.g.: **ENTER**
< >	Keys are marked bold within angle brackets e.g.: **<F5>**
`Courier`	The print font for program codes is Courier. e.g.: `END_VAR`

1.6 Number Notation

Number code	Example	Note
Decimal	100	Normal notation
Hexadecimal	0x64	C notation
Binary	'100' '0110.0100'	In quotation marks, nibble separated with dots (.)

1.7 Scope

This manual describes the field bus independent WAGO-I/O-SYSTEM 750 with the fieldbus coupler for PROFINET IO.

Item-No.	Description
750-370	Fieldbus Coupler PROFINET IO

1.8 Abbreviation

AI	Analog Input Analog Input Module
AO	Analog Output Analog Input Module
CPU	In this case the Run Time System for the eradication of the user program in the PFC
DI	Digital Input Digital Input Module
DO	Digital Output Digital Output Module
I/O	Input/Output
ID	Identifier
HB	High Byte
LB	Low Byte
PLC	Programmable Logic Controller
SW	Software Version

2 The WAGO-I/O-SYSTEM 750

2.1 System Description

The WAGO-I/O-SYSTEM 750 is a modular, field bus independent I/O system. It is comprised of a field bus coupler/controller (1) and connected field bus modules (2) for any type of signal. Together, these make up the field bus node. The end module (3) completes the node.

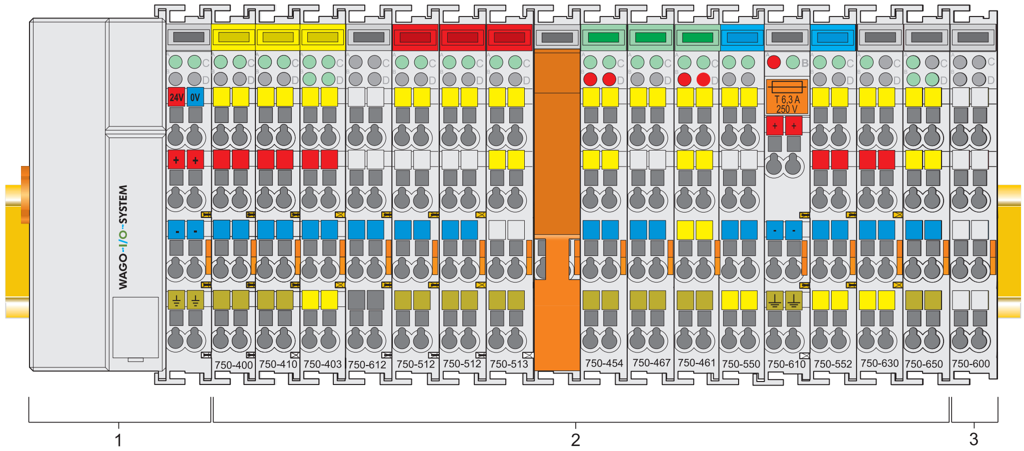


Fig. 2-1: Field bus node g0xxx00x

Couplers/controllers for field bus systems such as PROFIBUS, INTERBUS, ETHERNET TCP/IP, CAN (CANopen, DeviceNet, CAL), MODBUS, LON and others are available.

The coupler/controller contains the field bus interface, electronics and a power supply terminal. The field bus interface forms the physical interface to the relevant field bus. The electronics process the data of the bus modules and make it available for the field bus communication. The 24 V system supply and the 24 V field supply are fed in via the integrated power supply terminal. The field bus coupler communicates via the relevant field bus. The programmable field bus controller (PFC) enables the implementation of additional PLC functions. Programming is done with the WAGO I/O *PRO* CAA in accordance with IEC 61131-3.

Bus modules for diverse digital and analog I/O functions as well as special functions can be connected to the coupler/controller. The communication between the coupler/controller and the bus modules is carried out via an internal bus.

The WAGO-I/O-SYSTEM 750 has a clear port level with LEDs for status indication, insertable mini WSB markers and pullout group marker carriers. The 3-wire technology supplemented by a ground wire connection allows for direct sensor/actuator wiring.

2.2 Technical Data

Mechanic	
Material	Polycarbonate, Polyamide 6.6
Dimensions W x H* x L * from upper edge of DIN 35 rail - Coupler/Controller (Standard) - Coupler/Controller (ECO) - Coupler/Controller (FireWire) - I/O module, single - I/O module, double - I/O module, fourfold	 - 51 mm x 65 mm x 100 mm - 50 mm x 65 mm x 100 mm - 62 mm x 65 mm x 100 mm - 12 mm x 64 mm x 100 mm - 24 mm x 64 mm x 100 mm - 48 mm x 64 mm x 100 mm
Installation	on DIN 35 with interlock
Modular by	double feather key dovetail
Mounting position	any position
Marking	standard marking label type group marking label 8 x 47 mm
Connection	
Connection type	CAGE CLAMP®
Wire range	0.08 mm² ... 2.5 mm², AWG 28-14
Stripped length	8 … 9 mm, 9 … 10 mm for components with pluggable wiring (753-xxx)
Contacts	
Power jumpers contacts	blade/spring contact self-cleaning
Current via power contacts $_{max}$	10 A
Voltage drop at I $_{max}$	< 1 V/64 modules
Data contacts	slide contact, hard gold plated 1.5 µm, self-cleaning
Climatic environmental conditions	
Operating temperature	0 °C ... 55 °C, -20 °C … +60 °C for components with extended temperature range (750-xxx/025-xxx)
Storage temperature	-20 °C ... +85 °C
Relative humidity	5 % … 95 % without condensation
Resistance to harmful substances	acc. to IEC 60068-2-42 and IEC 60068-2-43
Maximum pollutant concentration at relative humidity < 75%	$SO_2 \leq 25$ ppm $H_2S \leq 10$ ppm
Special conditions	Ensure that additional measures for components are taken, which are used in an environment involving: – dust, caustic vapors or gases – ionization radiation

Safe electrical isolation	
Air and creepage distance	acc. to IEC 60664-1
Degree of pollution acc. To IEC 61131-2	2
Degree of protection	
Degree of protection	IP 20

Electromagnetic compatibility				
Immunity to interference for industrial areas acc. to EN 61000-6-2 (2001)				
Test specification	**Test values**		**Strength class**	**Evaluation criteria**
EN 61000-4-2 ESD	4 kV/8 kV (contact/air)		2/3	B
EN 61000-4-3 electromagnetic fields	10 V/m 80 MHz ... 1 GHz		3	A
EN 61000-4-4 burst	1 kV/2 kV (data/supply)		2/3	B
EN 61000-4-5 surge	Data:	-/- (line/line)		B
		1 kV (line/earth)	2	
	DC sup-ply:	0.5 kV (line/line)	1	B
		0.5 kV (line/earth)	1	
	AC sup-ply:	1 kV (line/line)	2	B
		2 kV (line/earth)	3	
EN 61000-4-6 RF disturbances	10 V/m 80 % AM (0.15 ... 80 MHz)		3	A

Emission of interference for industrial areas acc. to EN 61000-6-4 (2001)			
Test specification	**Limit values/[QP]*)**	**Frequency range**	**Distance**
EN 55011 (AC supply, conducted)	79 dB (µV)	150 kHz ... 500 kHz	
	73 dB (µV)	500 kHz ... 30 MHz	
EN 55011 (radiated)	40 dB (µV/m)	30 MHz ... 230 MHz	10 m
	47 dB (µV/m)	230 MHz ... 1 GHz	10 m

Emission of interference for residential areas acc. to EN 61000-6-3 (2001)			
Test specification	**Limit values/[QP]*)**	**Frequency range**	**Distance**
EN 55022 (AC supply, conducted)	66 ... 56 dB (µV)	150 kHz ... 500 kHz	
	56 dB (µV)	500 kHz ... 5 MHz	
	60 dB (µV)	5 MHz ... 30 MHz	
EN 55022 (DC supply/data, conducted)	40 ... 30 dB (µA)	150 kHz ... 500 kHz	
	30 dB (µA)	500 kHz ... 30 MHz	
EN 55022 (radiated)	30 dB (µV/m)	30 MHz ... 230 MHz	10 m
	37 dB (µV/m)	230 MHz ... 1 GHz	10 m

Mechanical strength acc. to IEC 61131-2		
Test specification	**Frequency range**	**Limit value**
IEC 60068-2-6 vibration	5 Hz ≤ f < 9 Hz	1.75 mm amplitude (permanent) 3.5 mm amplitude (short term)
	9 Hz ≤ f < 150 Hz	0.5 g (permanent) 1 g (short term)
	Note on vibration test: a) Frequency change: max. 1 octave/minute b) Vibration direction: 3 axes	
IEC 60068-2-27 shock		15 g
	Note on shock test: a) Type of shock: half sine b) Shock duration: 11 ms c) Shock direction: 3x in positive and 3x in negative direction for each of the three mutually perpendicular axes of the test specimen	
IEC 60068-2-32 free fall		1 m (module in original packing)

*) QP: Quasi Peak

Note
If the technical data of components differ from the values described here, the technical data shown in the manuals of the respective components shall be valid.

For Products of the WAGO-I/O-SYSTEM 750 with ship specific approvals supplementary guidelines are valid:

Electromagnetic compatibility				
Immunity to interference acc. to Germanischer Lloyd (2003)				
Test specification	**Test values**		**Strength class**	**Evaluation criteria**
IEC 61000-4-2 ESD	6 kV/8 kV (contact/air)		3/3	B
IEC 61000-4-3 electromagnetic fields	10 V/m 80 MHz ... 2 GHz		3	A
IEC 61000-4-4 burst	1 kV/2 kV (data/supply)		2/3	A
IEC 61000-4-5 surge	AC/DC Supply:	0.5 kV (line/line)	1	A
		1 kV (line/earth)	2	
IEC 61000-4-6 RF disturbances	10 V/m 80 % AM (0.15 ... 80 MHz)		3	A
Type test AF disturbances (harmonic waves)	3 V, 2 W		-	A
Type test high voltage	755 V DC 1500 V AC		-	-

Emission of interference acc. to Germanischer Lloyd (2003)			
Test specification	**Limit values**	**Frequency range**	**Distance**
Type test (EMC1, conducted) allows for ship bridge control applications	96 ... 50 dB (µV)	10 kHz ... 150 kHz	
	60 ... 50 dB (µV)	150 kHz ... 350 kHz	
	50 dB (µV)	350 kHz ... 30 MHz	
Type test (EMC1, radiated) allows for ship bridge control applications	80 ... 52 dB (µV/m)	150 kHz ... 300 kHz	3 m
	52 ... 34 dB (µV/m)	300 kHz ... 30 MHz	3 m
	54 dB (µV/m)	30 MHz ... 2 GHz	3 m
except:	24 dB (µV/m)	156 MHz ... 165 MHz	3 m

Mechanical strength acc. to Germanischer Lloyd (2003)		
Test specification	**Frequency range**	**Limit value**
IEC 60068-2-6 vibration (category A – D)	2 Hz ≤ f < 25 Hz	± 1.6 mm amplitude (permanent)
	25 Hz ≤ f < 100 Hz	4 g (permanent)
	Note on vibration test: a) Frequency change: max. 1 octave/minute b) Vibration direction: 3 axes	

Range of application	Required specification emission of interference	Required specification immunity to interference
Industrial areas	EN 61000-6-4 (2001)	EN 61000-6-2 (2001)
Residential areas	EN 61000-6-3 (2001)*)	EN 61000-6-1 (2001)

*) The system meets the requirements on emission of interference in residential areas with the field bus coupler/controller for:

ETHERNET	750-342/-841/-842/-860
LonWorks	750-319/-819
CANopen	750-337/-837
DeviceNet	750-306/-806
MODBUS	750-312/-314/ -315/ -316 750-812/-814/ -815/ -816
KNX	750-849
BACnet	750-830

With a special permit, the system can also be implemented with other field bus couplers/controllers in residential areas (housing, commercial and business areas, small-scale enterprises). The special permit can be obtained from an authority or inspection office. In Germany, the Federal Office for Post and Telecommunications and its branch offices issues the permit.

It is possible to use other field bus couplers/controllers under certain boundary conditions. Please contact WAGO Kontakttechnik GmbH & Co. KG.

Maximum power dissipation of the components	
Bus modules	0.8 W / bus terminal (total power dissipation, system/field)
Field bus coupler/controller	2.0 W / coupler/controller

Warning
The power dissipation of all installed components must not exceed the maximum conductible power of the housing (cabinet).

When dimensioning the housing, care is to be taken that even under high external temperatures, the temperature inside the housing does not exceed the permissible ambient temperature of 55 °C.

Dimensions

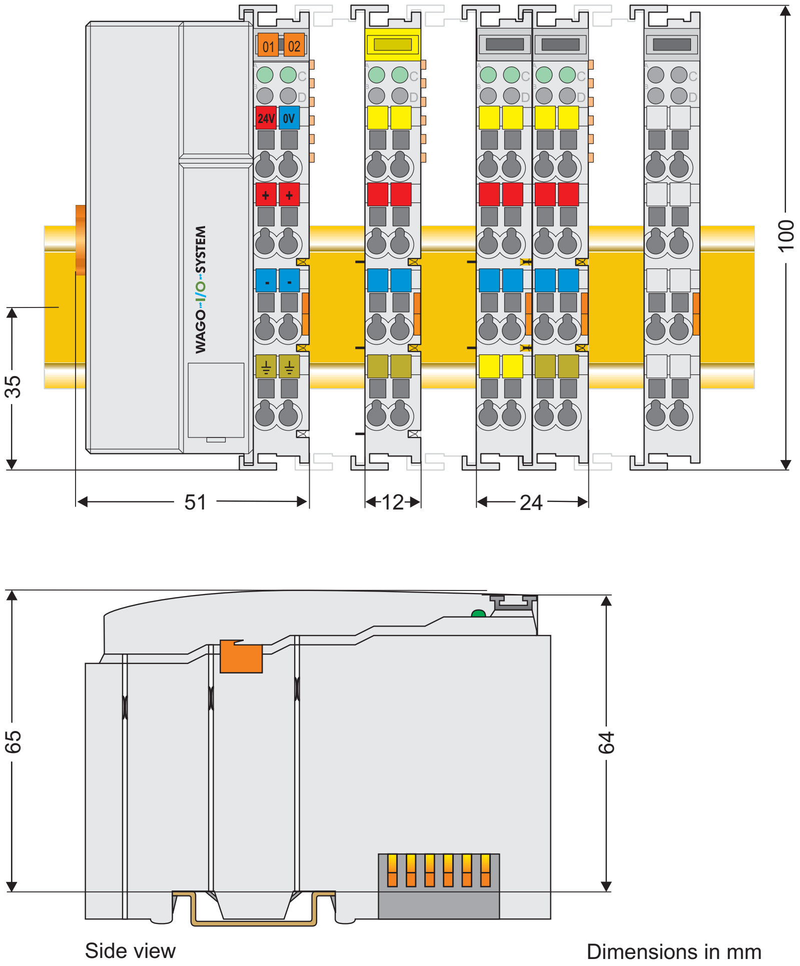


Fig. 2-2: Dimensions g01xx05e

Note
The illustration shows a standard coupler. For detailed dimensions, please refer to the technical data of the respective coupler/controller.

2.3 Manufacturing Number

The manufacturing number indicates the delivery status directly after production.
This number is part of the lateral marking on the component.
In addition, starting from calendar week 43/2000 the manufacturing number is also printed on the cover of the configuration and programming interface of the field bus coupler or controller.

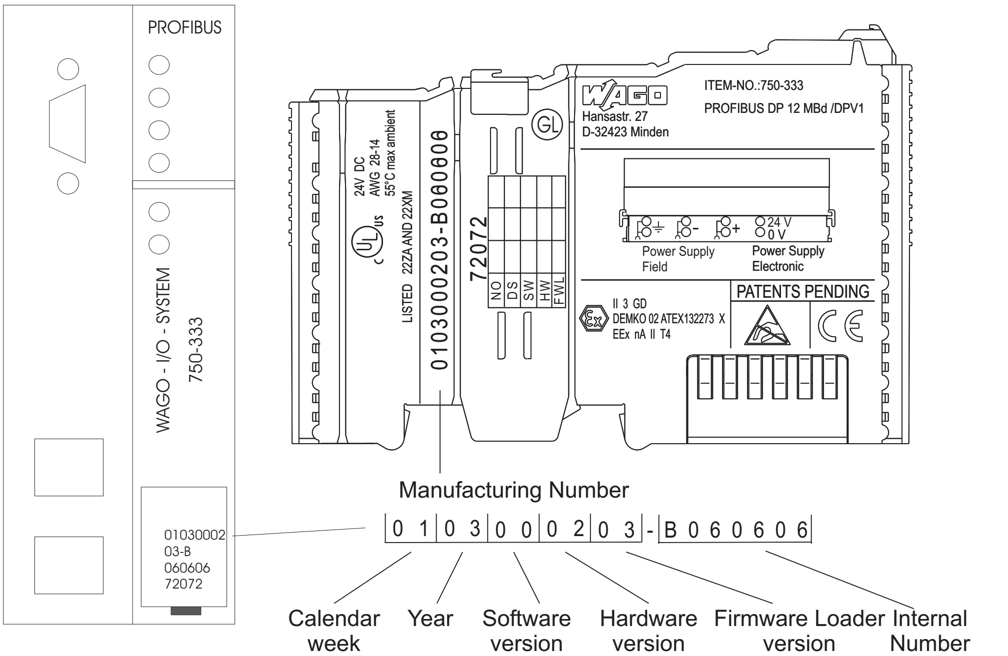


Fig. 2-3: Example: Manufacturing Number of a PROFIBUS field bus coupler 750-333
g01xx15e

The manufacturing number consists of the production week and year, the software version (if available), the hardware version of the component, the firmware loader (if available) and further internal information for WAGO Kontakttechnik GmbH & Co. KG.

2.4 Component Update

For the case of an Update of one component, the lateral marking on each component contains a prepared matrix.

This matrix makes columns available for altogether three updates to the entry of the current update data, like production order number (NO; starting from calendar week 13/2004), update date (DS), software version (SW), hardware version (HW) and the firmware loader version (FWL, if available).

Update Matrix

Current Version data for:		1. Update	2. Update	3. Update	
Production Order Number	**NO**				← only starting from calendar week 13/2004
Datestamp	**DS**				
Software index	**SW**				
Hardware index	**HW**				
Firmware loader index	**FWL**				← only for coupler/controller

If the update of a component took place, the current version data are registered into the columns of the matrix.

Additionally with the update of a field bus coupler or controller also the cover of the configuration and programming interface of the coupler or controller is printed on with the current manufacturing and production order number.

The original manufacturing data on the housing of the component remain thereby.

2.5 Storage, Assembly and Transport

Wherever possible, the components are to be stored in their original packaging. Likewise, the original packaging provides optimal protection during transport.

When assembling or repacking the components, the contacts must not be soiled or damaged. The components must be stored and transported in appropriate containers/packaging. Thereby, the ESD information is to be regarded.

Statically shielded transport bags with metal coatings are to be used for the transport of open components for which soiling with amine, amide and silicone has been ruled out, e.g. 3M 1900E.

2.6 Mechanical Setup

2.6.1 Installation Position

Along with horizontal and vertical installation, all other installation positions are allowed.

Attention
In the case of vertical assembly, an end stop has to be mounted as an additional safeguard against slipping.

WAGO item 249-116	End stop for DIN 35 rail, 6 mm wide
WAGO item 249-117	End stop for DIN 35 rail, 10 mm wide

2.6.2 Total Expansion

The length of the module assembly (including one end module of 12mm width) that can be connected to the coupler/controller is 780 mm. When assembled, the I/O modules have a maximum length of 768 mm.

Examples:

- 64 I/O modules of 12 mm width can be connected to one coupler/controller.
- 32 I/O modules of 24 mm width can be connected to one coupler/controller.

Exception:

The number of connected I/O modules also depends on which type of coupler/controller is used. For example, the maximum number of I/O modules that can be connected to a PROFIBUS coupler/controller is 63 without end module. The maximum total expansion of a node is calculated as follows:

Warning
The maximum total length of a node without coupler/controller must not exceed 780 mm. Furthermore, restrictions made on certain types of couplers/controllers must be observed (e.g. for PROFIBUS).

2.6.3 Assembly onto Carrier Rail

2.6.3.1 Carrier Rail Properties

All system components can be snapped directly onto a carrier rail in accordance with the European standard EN 50022 (DIN 35).

Warning
WAGO Kontakttechnik GmbH & Co. KG supplies standardized carrier rails that are optimal for use with the I/O system. If other carrier rails are used, then a technical inspection and approval of the rail by WAGO Kontakttechnik GmbH & Co. KG should take place.

Carrier rails have different mechanical and electrical properties. For the optimal system setup on a carrier rail, certain guidelines must be observed:

- The material must be non-corrosive.
- Most components have a contact to the carrier rail to ground electro-magnetic disturbances. In order to avoid corrosion, this tin-plated carrier rail contact must not form a galvanic cell with the material of the carrier rail which generates a differential voltage above 0.5 V (saline solution of 0.3% at 20°C) .
- The carrier rail must optimally support the EMC measures integrated into the system and the shielding of the bus module connections.
- A sufficiently stable carrier rail should be selected and, if necessary, several mounting points (every 20 cm) should be used in order to prevent bending and twisting (torsion).
- The geometry of the carrier rail must not be altered in order to secure the safe hold of the components. In particular, when shortening or mounting the carrier rail, it must not be crushed or bent.
- The base of the I/O components extends into the profile of the carrier rail. For carrier rails with a height of 7.5 mm, mounting points are to be riveted under the node in the carrier rail (slotted head captive screws or blind rivets).

2.6.3.2 WAGO DIN Rail

WAGO carrier rails meet the electrical and mechanical requirements.

Item Number	Description
210-113 /-112	35 x 7.5; 1 mm; steel yellow chromated; slotted/unslotted
210-114 /-197	35 x 15; 1.5 mm; steel yellow chromated; slotted/unslotted
210-118	35 x 15; 2.3 mm; steel yellow chromated; unslotted
210-198	35 x 15; 2.3 mm; copper; unslotted
210-196	35 x 7.5; 1 mm; aluminum; unslotted

2.6.4 Spacing

The spacing between adjacent components, cable conduits, casing and frame sides must be maintained for the complete field bus node.

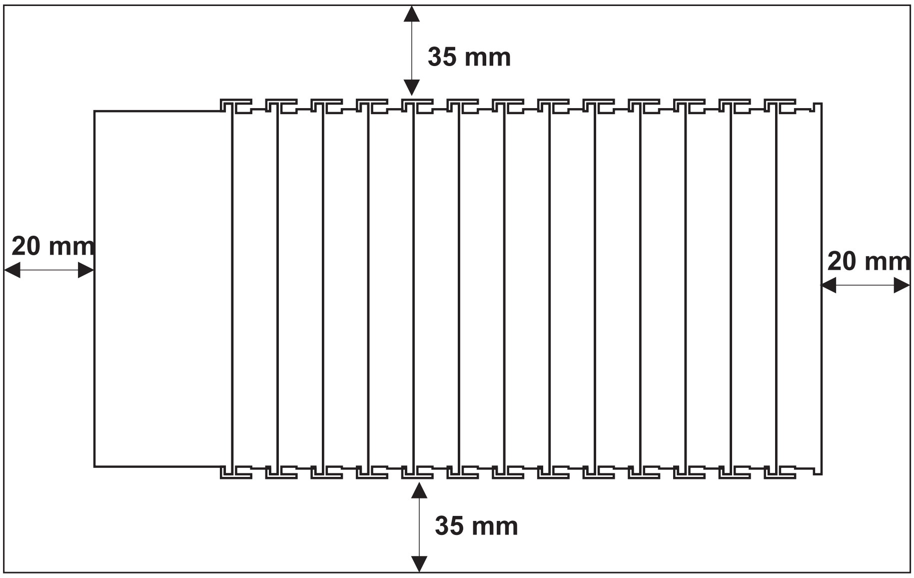


Fig. 2-4: Spacing g01xx13x

The spacing creates room for heat transfer, installation or wiring. The spacing to cable conduits also prevents conducted electromagnetic interferences from influencing the operation.

2.6.5 Plugging and Removal of the Components

Warning
Before work is done on the components, the voltage supply must be turned off.

In order to safeguard the coupler/controller from jamming, it should be fixed onto the carrier rail with the locking disc To do so, push on the upper groove of the locking disc using a screwdriver.

To pull out the field bus coupler/controller, release the locking disc by pressing on the bottom groove with a screwdriver and then pulling the orange colored unlocking lug .

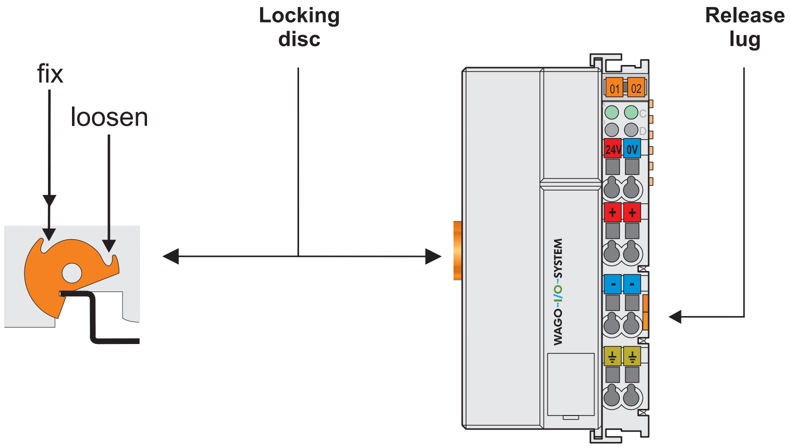


Fig. 2-5: Coupler/Controller and unlocking lug g01xx12e

It is also possible to release an individual I/O module from the unit by pulling an unlocking lug.

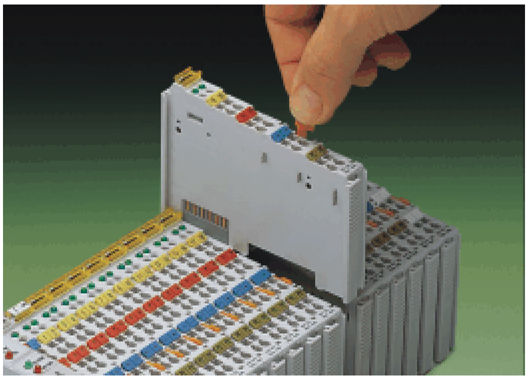


Fig. 2-6: removing bus terminal p0xxx01x

Danger
Ensure that an interruption of the PE will not result in a condition which could endanger a person or equipment!
For planning the ring feeding of the ground wire, please see chapter 2.6.3.

2.6.6 Assembly Sequence

All system components can be snapped directly on a carrier rail in accordance with the European standard EN 50022 (DIN 35).

The reliable positioning and connection is made using a tongue and groove system. Due to the automatic locking, the individual components are securely seated on the rail after installing.

Starting with the coupler/controller, the bus modules are assembled adjacent to each other according to the project planning. Errors in the planning of the node in terms of the potential groups (connection via the power contacts) are recognized, as the bus modules with power contacts (male contacts) cannot be linked to bus modules with fewer power contacts.

Attention
Always link the bus modules with the coupler/controller, and always plug from above.

Warning
Never plug bus modules from the direction of the end terminal. A ground wire power contact, which is inserted into a terminal without contacts, e.g. a 4-channel digital input module, has a decreased air and creepage distance to the neighboring contact in the example DI4.

Always terminate the field bus node with an end module (750-600).

2.6.7 Internal Bus/Data Contacts

Communication between the coupler/controller and the bus modules as well as the system supply of the bus modules is carried out via the internal bus. It is comprised of 6 data contacts, which are available as self-cleaning gold spring contacts.

Fig. 2-7: Data contacts p0xxx07x

Warning
Do not touch the gold spring contacts on the I/O modules in order to avoid soiling or scratching!

ESD (Electrostatic Discharge)
The modules are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the modules, ensure that the environment (persons, workplace and packing) is well grounded. Avoid touching conductive components, e.g. data contacts.

2.6.8 Power Contacts

Self-cleaning power contacts , are situated on the side of the components which further conduct the supply voltage for the field side. These contacts come as touchproof spring contacts on the right side of the coupler/controller and the bus module. As fitting counterparts the module has male contacts on the left side.

Danger
The male contacts are sharp-edged. Handle the module carefully to prevent injury.

Attention
Please take into consideration that some bus modules have no or only a few power jumper contacts. The design of some modules does not allow them to be physically assembled in rows, as the grooves for the male contacts are closed at the top.

Power jumper contacts

Blade	0	0	3	2
Spring	0	3	3	2

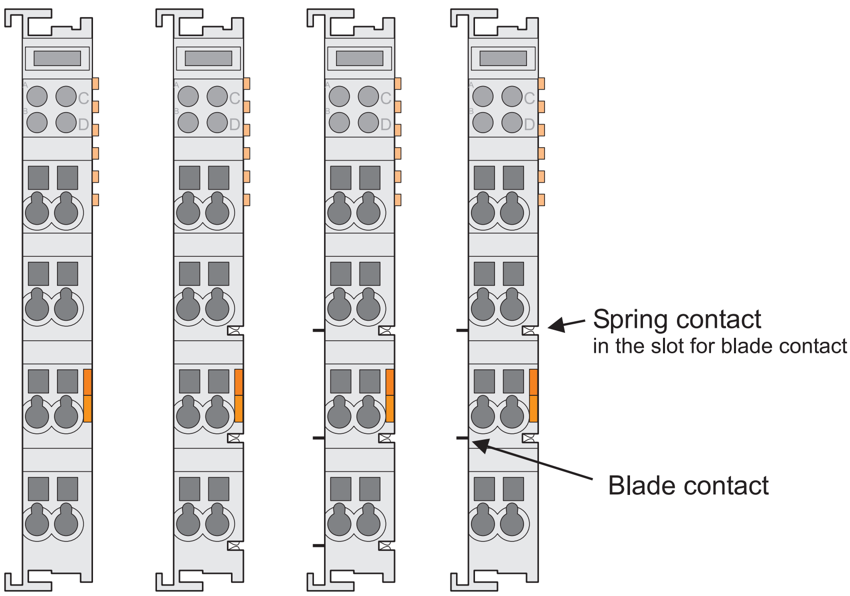


Fig. 2-8: Example for the arrangement of power contacts g0xxx05e

Recommendation
With the WAGO ProServe® Software smartDESIGNER, the structure of a field bus node can be configured. The configuration can be tested via the integrated accuracy check.

2.6.9 Wire Connection

All components have CAGE CLAMP® connections.

The WAGO CAGE CLAMP® connection is appropriate for solid, stranded and finely stranded conductors. Each clamping unit accommodates one conductor.

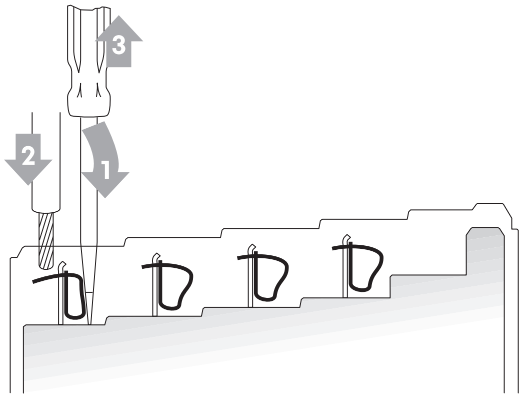


Fig. 2-9: CAGE CLAMP® Connection g0xxx08x

The operating tool is inserted into the opening above the connection. This opens the CAGE CLAMP®. Subsequently the conductor can be inserted into the opening. After removing the operating tool, the conductor is safely clamped.

More than one conductor per connection is not permissible. If several conductors have to be made at one connection point, then they should be made away from the connection point using WAGO Terminal Blocks. The terminal blocks may be jumpered together and a single wire brought back to the I/O module connection point.

Attention
If it is unavoidable to jointly connect 2 conductors, then a ferrule must be used to join the wires together.
Ferrule:

Length	8 mm
Nominal cross section $_{max.}$	1 mm^2 for 2 conductors with 0.5 mm^2 each
WAGO Product	216-103 or products with comparable properties

2.7 Power Supply

2.7.1 Isolation

Within the field bus node, there are three electrically isolated potentials.

- Operational voltage for the field bus interface.
- Electronics of the couplers/controllers and the bus modules (internal bus).
- All bus modules have an electrical isolation between the electronics (internal bus, logic) and the field electronics. Some digital and analog input modules have each channel electrically isolated, please see catalog.

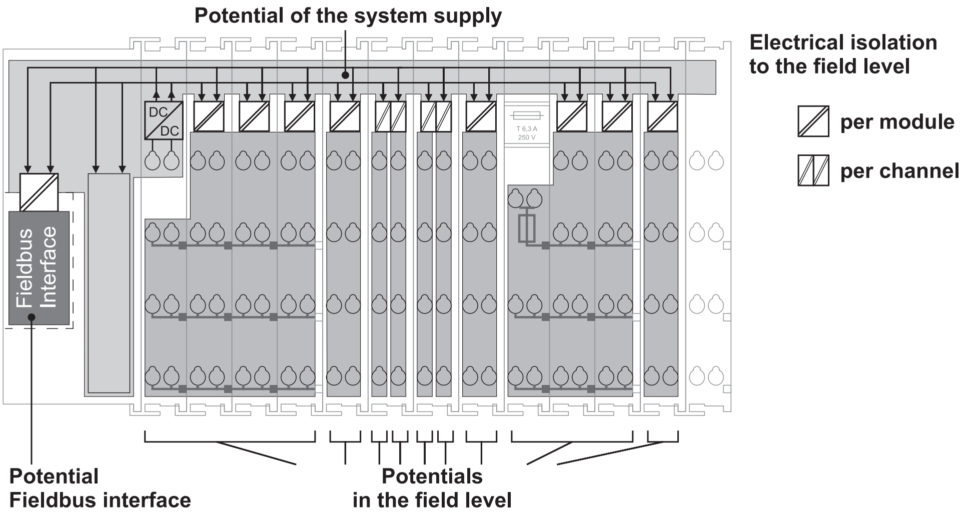


Fig. 2-10: Isolation g0xxx01e

Attention
The ground wire connection must be present in each group. In order that all protective conductor functions are maintained under all circumstances, it is recommended that a ground wire be connected at the beginning and end of a potential group. (ring format, please see chapter 2.8.3). Thus, if a bus module comes loose from a composite during servicing, then the protective conductor connection is still guaranteed for all connected field devices.

When using a joint power supply unit for the 24 V system supply and the 24 V field supply, the electrical isolation between the internal bus and the field level is eliminated for the potential group.

2.7.2 System Supply

2.7.2.1 Connection

The WAGO-I/O-SYSTEM 750 requires a 24 V direct current system supply (-15 % or +20 %). The power supply is provided via the coupler/controller and, if necessary, in addition via the internal system supply modules (750-613). The voltage supply is reverse voltage protected.

Attention
The use of an incorrect supply voltage or frequency can cause severe damage to the component.

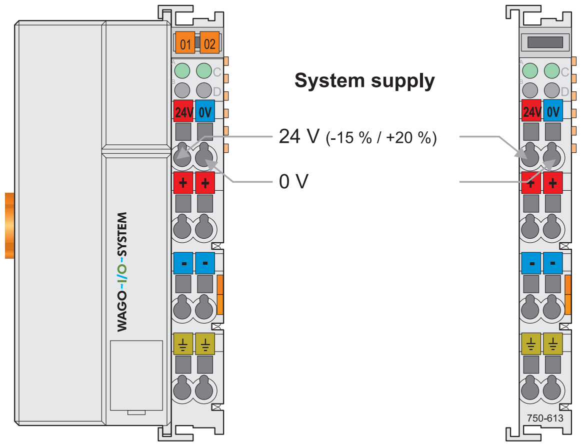


Fig. 2-11: System Supply g0xxx02e

The direct current supplies all internal system components, e.g. coupler/controller electronics, field bus interface and bus modules via the internal bus (5 V system voltage). The 5 V system voltage is electrically connected to the 24 V system supply.

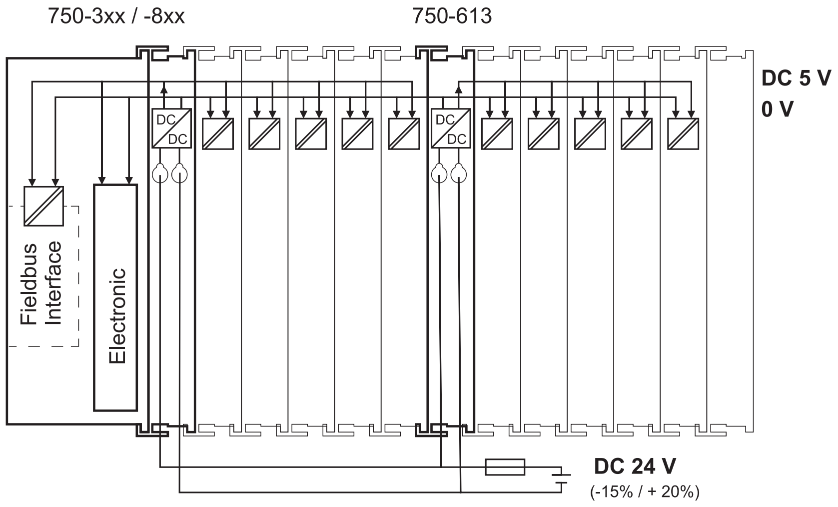


Fig. 2-12: System Voltage g0xxx06e

Attention
Resetting the system by switching on and off the system supply, must take place simultaneously for all supply modules (coupler/controller and 750-613).

2.7.2.2 Alignment

Recommendation
A stable network supply cannot be taken for granted always and everywhere. Therefore, regulated power supply units should be used in order to guarantee the quality of the supply voltage.

The supply capacity of the coupler/controller or the internal system supply module (750-613) can be taken from the technical data of the components.

Internal current consumption*)	Current consumption via system voltage: 5 V for electronics of the bus modules and coupler/controller
Residual current for bus terminals*)	Available current for the bus modules. Provided by the bus power supply unit. See coupler/controller and internal system supply module (750-613)

*) cf. catalogue W4 Volume 3, manuals or internet

Example	**Coupler 750-301:**	
	internal current consumption:350 mA at 5 V	
	residual current for	
	bus modules:	1650 mA at 5 V
	sum $I_{(5V)\ total}$:	2000 mA at 5 V

The internal current consumption is indicated in the technical data for each bus terminal. In order to determine the overall requirement, add together the values of all bus modules in the node.

Attention
If the *sum of the internal current consumption* exceeds the *residual current for bus modules*, then an internal system supply module (750-613) must be placed before the module where the permissible residual current was exceeded.

Example: A node with a PROFIBUS Coupler 750-333 consists of 20 relay modules (750-517) and 10 digital input modules (750-405).

Current consumption:
20* 90 mA = 1800 mA
10* 2 mA = 20 mA
Sum 1820 mA

The coupler can provide 1650 mA for the bus modules. Consequently, an internal system supply module (750-613), e.g. in the middle of the node, should be added.

Recommendation
With the WAGO ProServe® Software smartDESIGNER, the assembly of a field bus node can be configured. The configuration can be tested via the integrated accuracy check.

The maximum input current of the 24 V system supply is 500 mA. The exact electrical consumption ($I_{(24\ V)}$) can be determined with the following formulas:

Coupler/Controller

$I_{(5\ V)\ total}$ = *Sum of all the internal current consumption of the connected bus modules*
+ internal current consumption coupler/controller

750-613

$I_{(5\ V)\ total}$ = *Sum of all the internal current consumption of the connected bus modules*

Input current $I_{(24\ V)}$ = $5\ V / 24\ V * I_{(5\ V)\ total} / \eta$

η = 0.87 (at nominal load)

Attention
If the electrical consumption of the power supply point for the 24 V-system supply exceeds 500 mA, then the cause may be an improperly aligned node or a defect.

During the test, all outputs, in particular those of the relay modules, must be active.

2.7.3 Field Supply

2.7.3.1 Connection

Sensors and actuators can be directly connected to the relevant channel of the bus module in 1/4 conductor connection technology. The bus module supplies power to the sensors and actuators. The input and output drivers of some bus modules require the field side supply voltage.

The coupler/controller provides field side power (DC 24V). In this case it is a passive power supply without protection equipment.
Power supply modules are available for other potentials, e. g. AC 230 V. Likewise, with the aid of the power supply modules, various potentials can be set up. The connections are linked in pairs with a power contact.

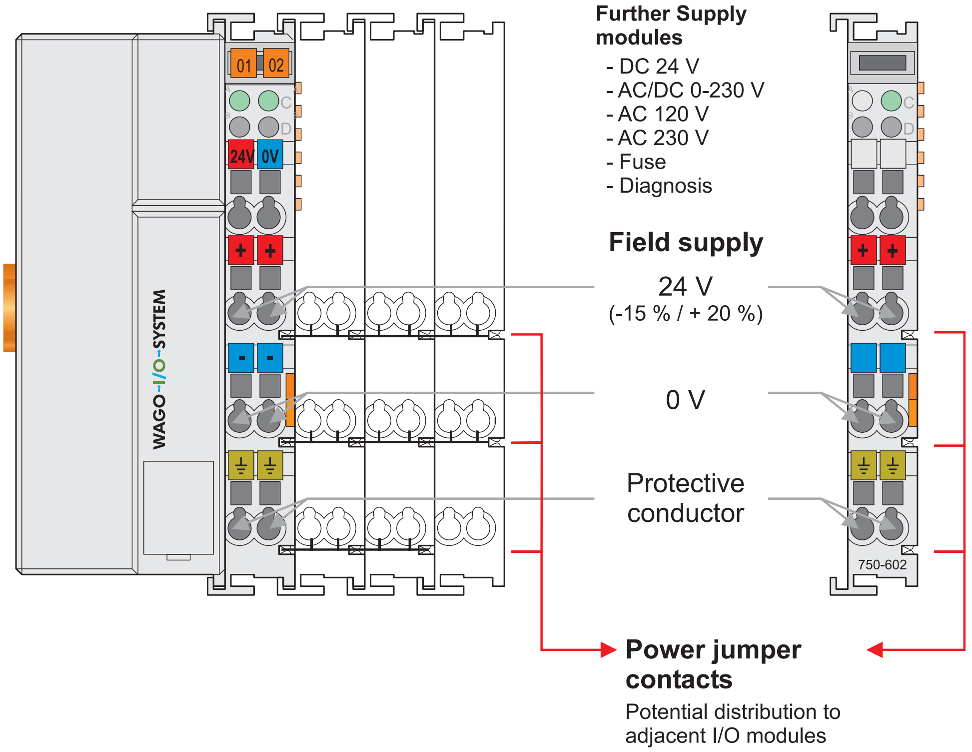


Fig. 2-13: Field Supply (Sensor/Actuator) g0xxx03e

The supply voltage for the field side is automatically passed to the next module via the power jumper contacts when assembling the bus modules .

The current load of the power contacts must not exceed 10 A on a continual basis. The current load capacity between two connection terminals is identical to the load capacity of the connection wires.

By inserting an additional power supply module, the field supply via the power contacts is disrupted. From there a new power supply occurs which may also contain a new voltage potential.

Attention
Some bus modules have no or very few power contacts (depending on the I/O function). Due to this, the passing through of the relevant potential is disrupted. If a field supply is required for subsequent bus modules, then a power supply module must be used.
Note the data sheets of the bus modules.

In the case of a node setup with different potentials, e.g. the alteration from DC 24 V to AC 230V, a spacer module should be used. The optical separation of the potentials acts as a warning to heed caution in the case of wiring and maintenance works. Thus, the results of wiring errors can be prevented.

2.7.3.2 Fusing

Internal fusing of the field supply is possible for various field voltages via an appropriate power supply module.

750-601	24 V DC, Supply/Fuse
750-609	230 V AC, Supply/Fuse
750-615	120 V AC, Supply/Fuse
750-610	24 V DC, Supply/Fuse/Diagnosis
750-611	230 V AC, Supply/Fuse/Diagnosis

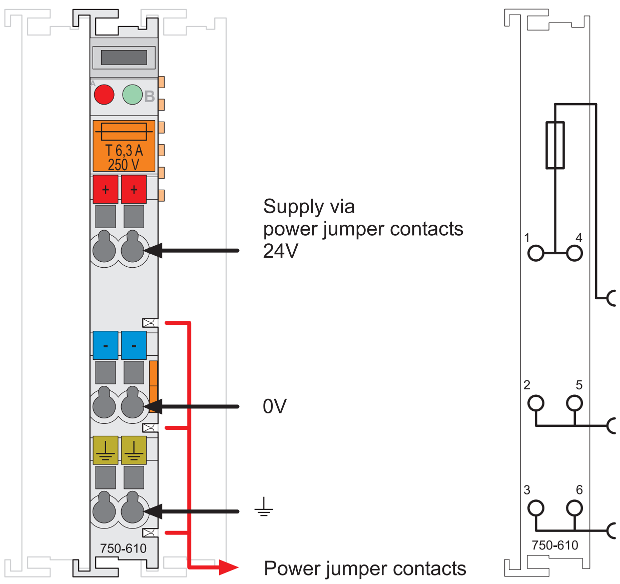


Fig. 2-14: Supply module with fuse carrier (Example 750-610) g0xxx09x

Warning
In the case of power supply modules with fuse holders, only fuses with a maximum dissipation of 1.6 W (IEC 127) must be used.
For UL approved systems only use UL approved fuses.

In order to insert or change a fuse, or to switch off the voltage in succeeding bus modules, the fuse holder may be pulled out. In order to do this, use a screwdriver for example, to reach into one of the slits (one on both sides) and pull out the holder.

Fig. 2-15: Removing the fuse carrier p0xxx05x

Lifting the cover to the side opens the fuse carrier.

Fig. 2-16: Opening the fuse carrier p0xxx03x

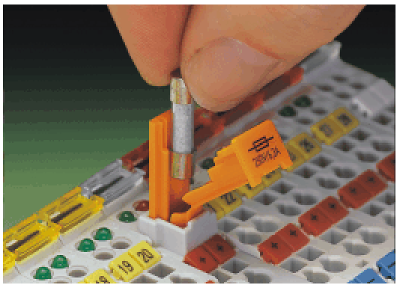


Fig. 2-17: Change fuse p0xxx04x

After changing the fuse, the fuse carrier is pushed back into its original position.

Alternatively, fusing can be done externally. The fuse modules of the WAGO series 281 and 282 are suitable for this purpose.

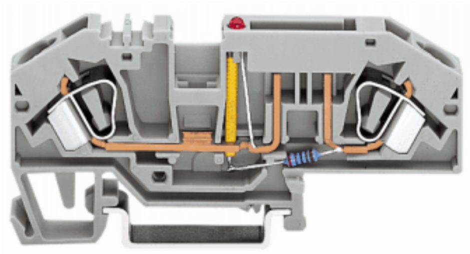


Fig. 2-18: Fuse modules for automotive fuses, series 282 pf66800x

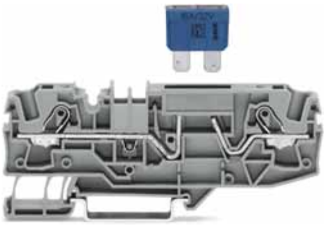


Abb. 2-19: Fuse modules for automotive fuses, series 2006 p0xxx13x

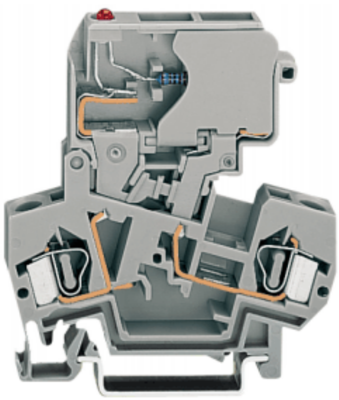


Fig. 2-20: Fuse modules with pivotable fuse carrier, series 281 pe61100x

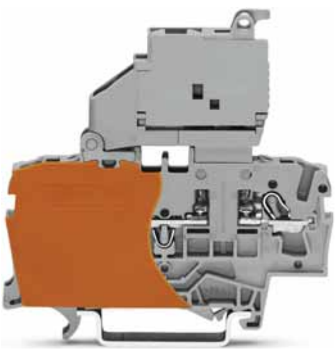


Abb. 2-21: Fuse modules with pivotable fuse carrier, series 2002 p0xxx12x

2.7.4 Supplementary Power Supply Regulations

The WAGO-I/O-SYSTEM 750 can also be used in shipbuilding or offshore and onshore areas of work (e. g. working platforms, loading plants). This is demonstrated by complying with the standards of influential classification companies such as Germanischer Lloyd and Lloyds Register.

Filter modules for 24-volt supply are required for the certified operation of the system.

Item No.	Name	Description
750-626	Supply filter	Filter module for system supply and field supply (24 V, 0 V), i.e. for field bus coupler/controller and bus power supply (750-613)
750-624	Supply filter	Filter module for the 24 V- field supply (750-602, 750-601, 750-610)

Therefore, the following power supply concept must be absolutely complied with.

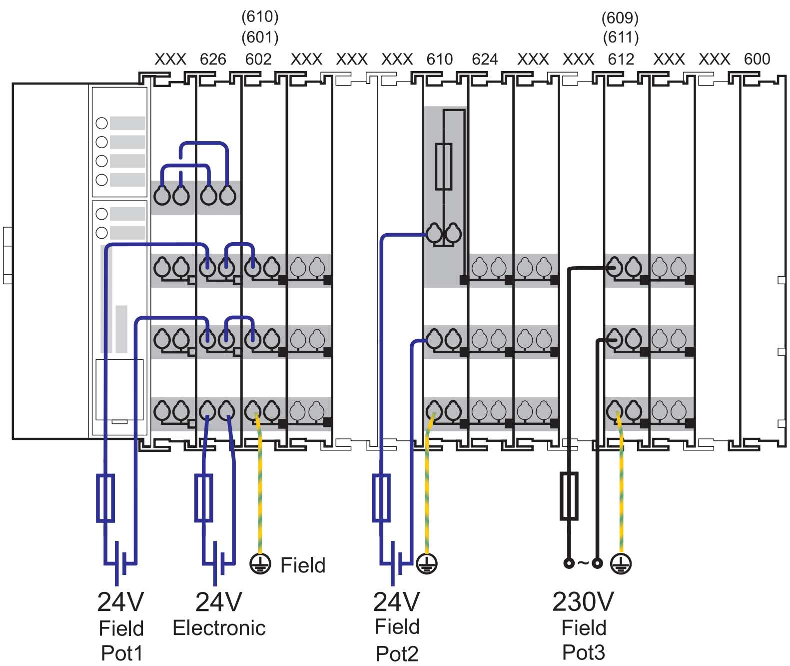


Fig. 2-22: Power supply concept g01xx11e

Note
Another potential power terminal 750-601/602/610 must only be used behind the filter terminal 750-626 if the protective earth conductor is needed on the lower power contact or if a fuse protection is required.

2.7.5 Supply Example

Attention
The system supply and the field supply should be separated in order to ensure bus operation in the event of a short-circuit on the actuator side.

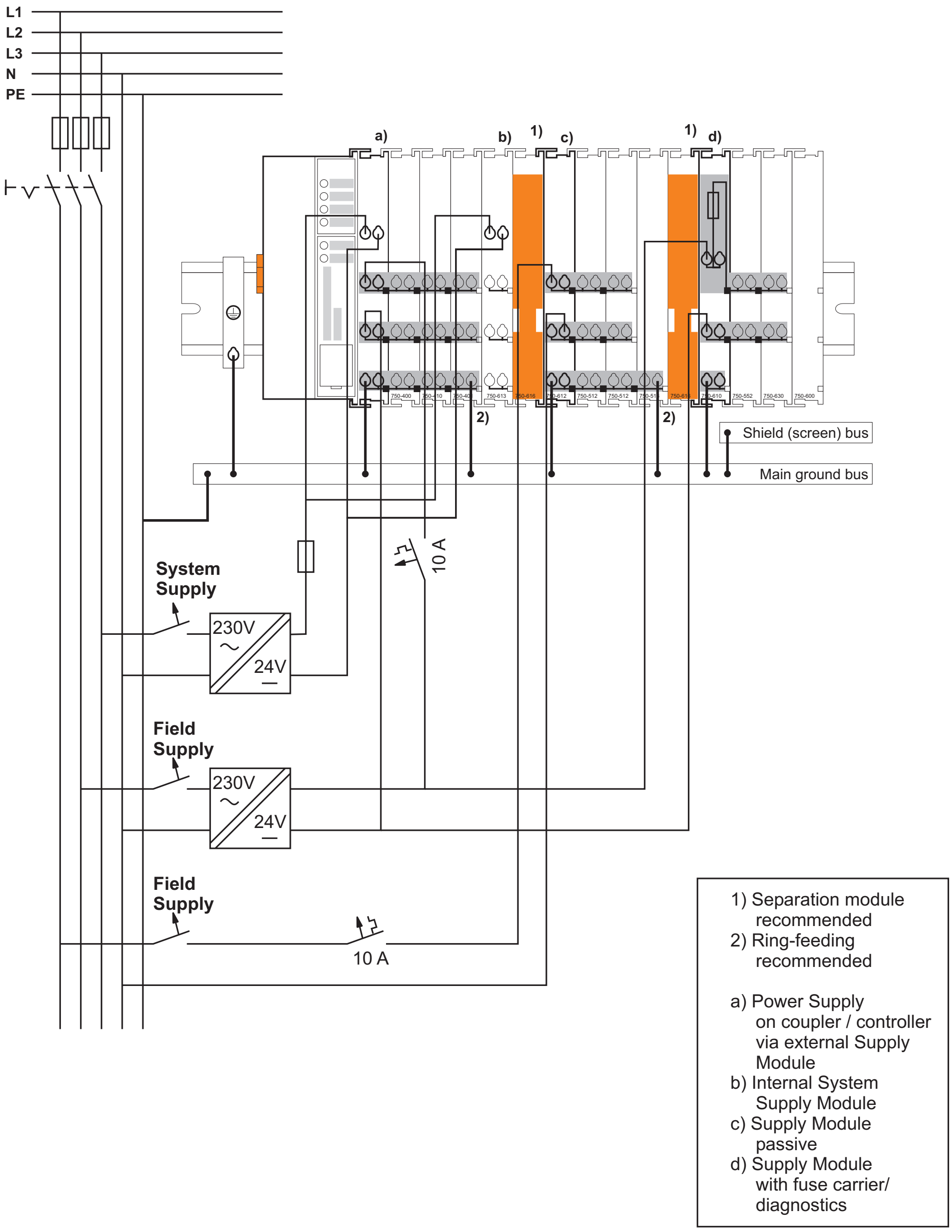


Fig. 2-23: Supply example g0xxx04e

2.7.6 Power Supply Unit

The WAGO-I/O-SYSTEM 750 requires a 24 V direct current system supply with a maximum deviation of -15 % or +20 %.

Recommendation
A stable network supply cannot be taken for granted always and everywhere. Therefore, regulated power supply units should be used in order to guarantee the quality of the supply voltage.

A buffer (200 µF per 1 A current load) should be provided for brief voltage dips. The I/O system buffers for approx 1 ms.

The electrical requirement for the field supply is to be determined individually for each power supply point. Thereby all loads through the field devices and bus modules should be considered. The field supply as well influences the bus modules, as the inputs and outputs of some bus modules require the voltage of the field supply.

Attention
The system supply and the field supply should be isolated from the power supplies in order to ensure bus operation in the event of short circuits on the actuator side.

WAGO products Item No.	Description
787-612	Primary switched mode; DC 24 V; 2,5 A Input nominal voltage AC 230 V
787-622	Primary switched mode; DC 24 V; 5 A Input nominal voltage AC 230 V
787-632	Primary switched mode; DC 24 V; 10 A Input nominal voltage AC 230/115 V
 288-809 288-810 288-812 288-813	Rail-mounted modules with universal mounting carrier AC 115 V / DC 24 V; 0,5 A AC 230 V / DC 24 V; 0,5 A AC 230 V / DC 24 V; 2 A AC 115 V / DC 24 V; 2 A

2.8 Grounding

2.8.1 Grounding the DIN Rail

2.8.1.1 Framework Assembly

When setting up the framework, the carrier rail must be screwed together with the electrically conducting cabinet or housing frame. The framework or the housing must be grounded. The electronic connection is established via the screw. Thus, the carrier rail is grounded.

Attention
Care must be taken to ensure the flawless electrical connection between the carrier rail and the frame or housing in order to guarantee sufficient grounding.

2.8.1.2 Insulated Assembly

Insulated assembly has been achieved when there is constructively no direct conduction connection between the cabinet frame or machine parts and the carrier rail. Here the earth must be set up via an electrical conductor.

The connected grounding conductor should have a cross section of at least 4 mm^2.

Recommendation
The optimal insulated setup is a metallic assembly plate with grounding connection with an electrical conductive link with the carrier rail.

The separate grounding of the carrier rail can be easily set up with the aid of the WAGO ground wire terminals.

Item No.	Description
283-609	1-conductor ground (earth) terminal block make an automatic contact to the carrier rail; conductor cross section: 0.2 -16 mm^2 **Note**: Also order the end and intermediate plate (283-320).

2.8.2 Grounding Function

The grounding function increases the resistance against disturbances from electro-magnetic interferences. Some components in the I/O system have a carrier rail contact that dissipates electro-magnetic disturbances to the carrier rail.

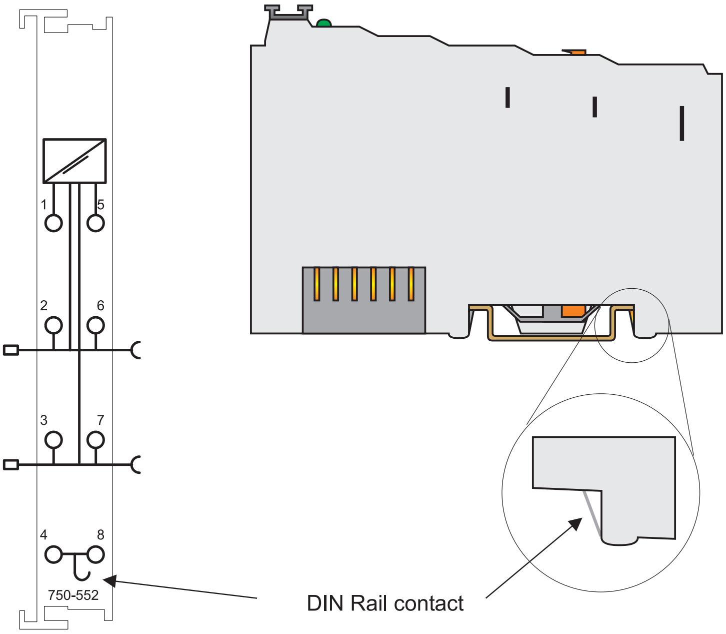


Fig. 2-24: Carrier rail contact g0xxx10e

Attention
Care must be taken to ensure the direct electrical connection between the carrier rail contact and the carrier rail.

The carrier rail must be grounded.

For information on carrier rail properties, please see chapter 2.6.3.1.

2.8.3 Grounding Protection

For the field side, the ground wire is connected to the lowest connection terminals of the power supply module. The ground connection is then connected to the next module via the Power Jumper Contact (PJC). If the bus module has the lower power jumper contact, then the ground wire connection of the field devices can be directly connected to the lower connection terminals of the bus module.

Attention
Should the ground conductor connection of the power jumper contacts within the node become disrupted, e. g. due to a 4-channel bus terminal, the ground connection will need to be re-established.

The ring feeding of the grounding potential will increase the system safety. When one bus module is removed from the group, the grounding connection will remain intact.

The ring feeding method has the grounding conductor connected to the beginning and end of each potential group.

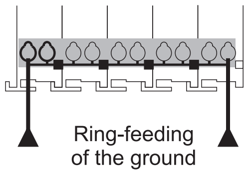


Fig. 2-25: Ring-feeding g0xxx07e

Attention
The regulations relating to the place of assembly as well as the national regulations for maintenance and inspection of the grounding protection must be observed.

2.9 Shielding (Screening)

2.9.1 General

The shielding of the data and signal conductors reduces electromagnetic interferences thereby increasing the signal quality. Measurement errors, data transmission errors and even disturbances caused by overvoltage can be avoided.

Attention
Constant shielding is absolutely required in order to ensure the technical specifications in terms of the measurement accuracy.

The data and signal conductors should be separated from all high-voltage cables.

The cable shield should be potential. With this, incoming disturbances can be easily diverted.

The shielding should be placed over the entrance of the cabinet or housing in order to already repel disturbances at the entrance.

2.9.2 Bus Conductors

The shielding of the bus conductor is described in the relevant assembly guidelines and standards of the bus system.

2.9.3 Signal Conductors

Bus modules for most analog signals along with many of the interface bus modules include a connection for the shield.

Note
For a better shield performance, the shield should have previously been placed over a large area. The WAGO shield connection system is suggested for such an application.
This suggestion is especially applicable if the equipment can have even current or high impulse formed currents running through (for example initiated by atmospheric discharge).

2.9.4 WAGO Shield (Screen) Connecting System

The WAGO Shield Connecting system includes a shield clamping saddle, a collection of rails and a variety of mounting feet. Together these allow many different possibilities. See catalog W4 volume 3 chapter 10.

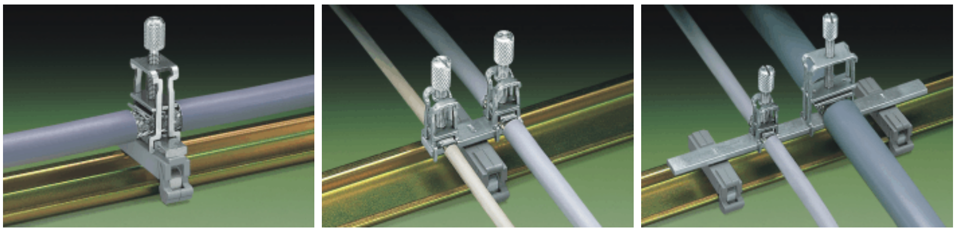


Fig. 2-26: WAGO Shield (Screen) Connecting System p0xxx08x, p0xxx09x, and p0xxx10x

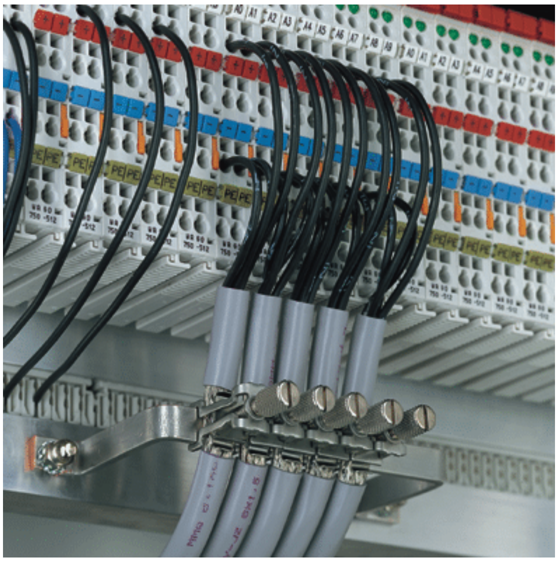


Fig. 2-27: Application of the WAGO Shield (Screen) Connecting System p0xxx11x

2.10 Assembly Guidelines/Standards

DIN 60204,	Electrical equipping of machines
DIN EN 50178	Equipping of high-voltage systems with electronic components (replacement for VDE 0160)

3 Fieldbus Coupler

3.1 PROFINET IO 750-370

3.1.1 Description

The fieldbus coupler 750-370 maps the peripheral data of almost all I/O modules in the WAGO-I/O-SYSTEM 750/753 on PROFINET IO.

In the initialization phase, the fieldbus coupler determines the physical structure of the node and creates a local process image with all inputs and outputs. I/O modules with a bit width smaller than 8 can be combined to form one byte, one word or one double word in order to optimize the address space.

The diagnostic concept is based on channel specific diagnostic messages that are additionally mapped to the respective alarms. Coding is done according to IEC 61158 (PROFINET IO).

The bus coupler has the following features:

- Process data length
  max. 320 byte input data including all user data qualifiers
  (max. 3 byte process data qualifiers (IOPS) for station substitute,
  (max. 2 byte process data qualifiers (IOXS) for each in- and output module)
  max. 320 byte output data including all user data qualifiers
  (max. 3 byte process data qualifiers (IOCS) for station substitute
  (max. 2 byte process data qualifiers (IOXS) for each output module)

- Transfer speed of up to 100 Mbit/s full-duplex, also with autonegotiation (factory settings)

- Support of all WAGO-I/O-SYSTEM 750/753 I/O modules
  except for PROFIsafe V1 Module 750-660/000-001 and 750-665/000-001, 2-Channel Analog Input Module 4-20 mA HART 75x-482 and 75x-484 and 4-Channel IO-Link Master 75x-657.

- Configurable data format for each signal channel of complex I/O modules.

- Configurable substitute value behavior for each output module in the event of failure.

- Configurable substitute values for each output channel in the event of failure

- 1 x RJ-45 bus connection

3.1.2 Hardware

3.1.2.1 View

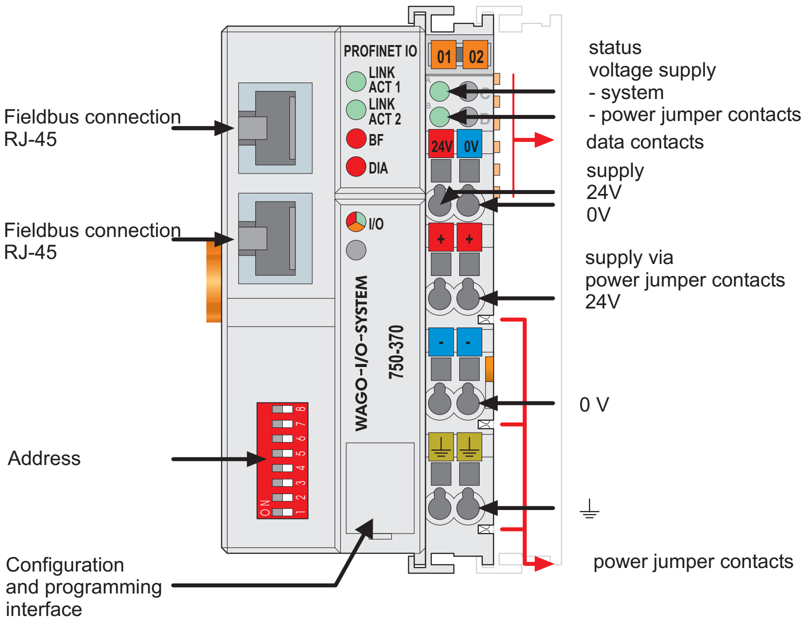


Fig. 3.1.2-1: View g037000e

The fieldbus coupler consists of:

- Power supply for the system as well as power jumper contacts for the field side supply via I/O modules.
- Fieldbus connection via two RJ-45 sockets (2-Port Switch)
- DIP switch option for device name assignment
- Display elements (LEDs) for operation status, fieldbus communication, operating voltages as well as fault messages and diagnostics.
- Configurations interface
- Electronics for communication with the I/O modules (internal bus) and the fieldbus interface.

3.1.2.2 Power Supply

The power is supplied via terminals with CAGE CLAMP® connection. The power supply provides power to both the system and the field side.

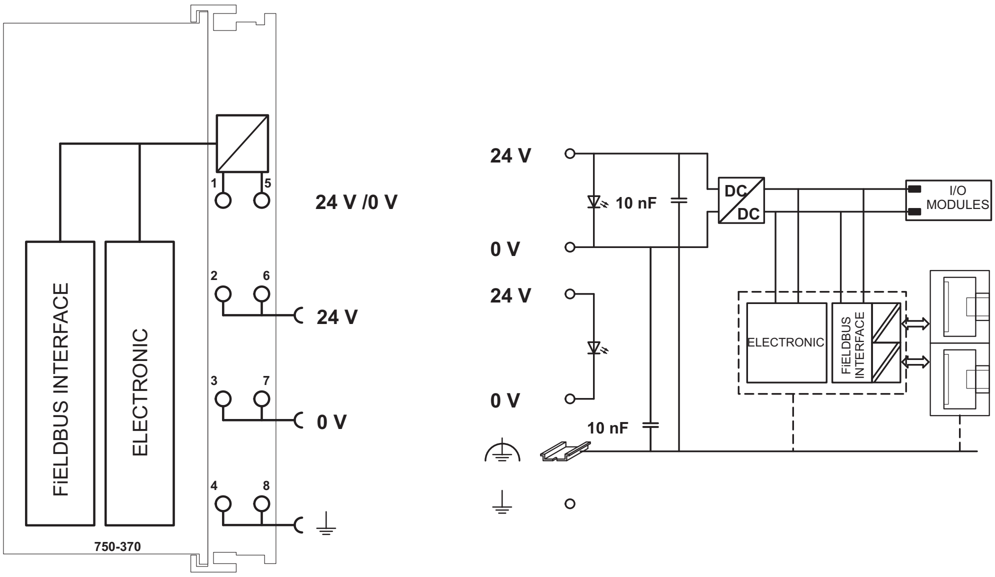


Fig. 3.1.2-2: Power supply g037001e

The integrated power supply unit provides the required power to the electronics and to the I/O modules.

The electrical isolation between the two RJ-45 Ethernet connectors and the electronics is provided by a transformer each.

3.1.2.3 Fieldbus Connection

The PROFINET IO interface is designed as a RJ-45 connection and complies with 100BaseTX standards.

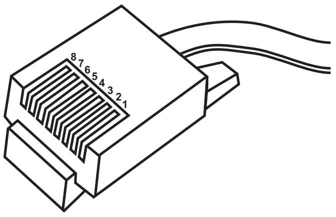


Fig. 3.1.2-3:
Bus connection RJ-45, plug g0xxx20x

Pin	Signal	Description
1	TD +	Send data +
2	TD -	Send data -
3	RD +	Receiving data +
4	-	Not assigned
5	-	Not assigned
6	RD -	Receiving data -
7	-	Not assigned
8	-	Not assigned

The connection point of the coupler is lowered to fit in an 80 mm high switch box once connected to the PROFINET connector.

3.1.2.4 Display Elements

The operating status of the fieldbus coupler or of the fieldbus node is indicated via light emitting diodes (LEDs).

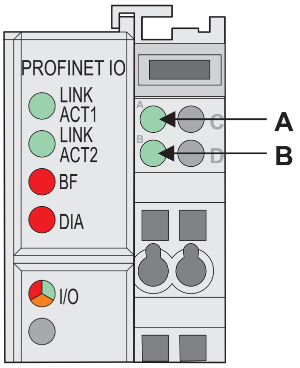


Fig. 3.1.2-4:
Display elements g037002x

LED	Color	Significance
LNK ACT 1	green	The "LNK/ACT" LEDs indicates that a physical connection to the Ethernet port 1 or 2 is etablished. They flash with a frequency of 2 Hz for a period of 3 seconds when the fieldbus coupler is requested to the participant flash test by the DCP protocol (**D**iscovery and basic **C**onfiguration **P**rotocol).
LNK ACT 2	green	
BF	red	The "BF" LED provides information on the current status of the PROFINET IO data exchange.
DIA	red	The "DIA" LED indicates the upcoming of diagnostic events. Diagnostic notifications are not supported by all I/O modules or have explicitly be enabled for each channel.
I/O	red/green/ orange	The "I/O" LED indicates both the internal bus communication and occurring errors.
A	green	Status of the operating voltage – system
B	green	Status of the operating voltage – power jumper contacts.

3.1.2.5 Configuration Interface

The configuration interface is located behind the cover flap. It is used for communicating with WAGO-I/O-CHECK 2 and optionally for updating the device software (firmware).

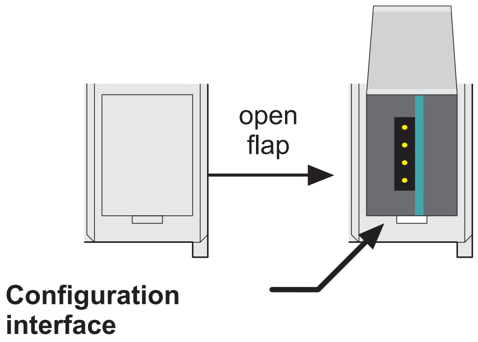


Fig. 3.1.2-5: Configuration interface g01xx06e

Fitting the 4-pole male connector to the RS-232 DSub9 connector is done using the WAGO configuration cable 750-920.

Caution
The communication cable 750-920 must not be connected or removed when energized, i.e. the coupler/controller must be voltage free!

3.1.3 IO Device Configuration

The fieldbus coupler takes over the task of the IO device in PROFINET IO. This way, an IO controller can access the process data of the I/O module periphery after the cyclic exchange of productive data has been successfully established. Selecting the I/O modules for the process data exchange and defining the time grid is done when configuring the IO controller. The configuration and parameter settings of the fieldbus coupler and I/O modules are based on the device's GSD file.

3.1.3.1 GSD File

Under PROFIBUS IO, the features of the devices are described by the manufacturer in form of a GSD file and made available to the user. The file is provided in XML format.

Structure, content and coding of the device specifications are standardized, so that any IO devices can be configured using manufacturer-independent tools.

Further Information
The PNO provides information about the GSD files of all listed manufacturers.

GSD and symbol files for configuring the WAGO IO devices can be obtained on CD under the item number 750-916 or on the WAGO INTERNET site.

http://www.wago.com

GSD file for IO device 750-370	**gsdml-V2.x-wago-series750_753-YYYYMMDD.xml**

The GSD file is read by the configuration software and the corresponding settings are transferred. For the necessary entries and handling steps, please refer to the software user manuals.

3.1.3.2 Configuration

The IO device is configured in accordance with the physical arrangement of the node (slot oriented).

Module slot 0 contains the fieldbus coupler in its function as station proxy. It does not deliver any process data itself, but provides the parameters required to perform overall settings of the IO device.

The slots 1 to max. 128 reflect the physical arrangement of the I/O modules that deliver a part of the process and/or diagnostic data. Supply modules without diagnostics, internal system supply modules, field side connection modules as well as separation and end modules are not considered during configuration as they do not provide any process data and/or diagnostic data.

For each I/O module, up to 8 configuration modules are available in the hardware catalog. The modules are designated by their item number followed by the number of signal channels, e.g. 75x-467 2AI. Additional information is included in the module description as different configuration possibilities are available (see below).

3.1.3.2.1 Configuring Digital I/O Modules

For digital I/O modules with a granularity smaller or equal to 8 bits four configuration entries are listed in the IO device hardware catalog. Three of them reserve 1, 2 or 4 bytes in the respective area, one of them is used to fill the reserved areas. The 2- and 4-byte modules can be found in the hardware catalog under the sub-category “Word/Double Word Modules”. With configuration modules that require more process image memory than the level of existing information of the respective I/O modules, the amount of bit information, which is still available in the allocated area, is indicated in brackets with a positive sign.

The item numbers of the modules, that do not provide a process image memory but are used to fill previously excessively reserved bit information, are marked with a star (*). Furthermore, the module names that are represented with a negative sign in brackets contain the amount of information that has been previously allocated in the area of the process image by the I/O module.

Module	Description	Name example
DI_32	Configuration module for 32 digital inputs, 4 bytes are reserved in the input process image of the IO controller. The bit information in the first byte is allocated to the input data of the configured I/O module according to the number of existing signal channels. Remaining bit locations (shown with a positive sign in brackets) can be allocated to the signal states of the following I/O modules having the same type of signal. This is done by configuring the ***DI_***0 modules of the relevant I/O modules.	**75x-400 2DI(+30 BIT I)**
DI_16	Configuration module for 16 digital inputs, 2 bytes are reserved in the input process image of the IO controller. The bit information in the first byte is allocated to the input data of the configured I/O module according to the number of existing signal channels. Remaining bit locations (shown with a positive sign in brackets) can be allocated to the signal states of the following I/O modules having the same type of signal. This is done by configuring the ***DI_0*** modules of the relevant I/O modules.	**75x-400 2DI(+14 BIT I)**
DI_8	Configuration module for 8 digital inputs, 1 byte is reserved in the input process image of the IO controller. The bit information in the first byte is allocated to the input data of the configured I/O module according to the number of existing signal channels. Remaining bit locations (shown with a positive signal in brackets) can be allocated to the signal states of the following I/O modules having the same type of signal. This is done by configuring the ***DI_0*** modules of the relevant I/O modules.	**75x-400 2DI(+6 BIT I)**
DI_0	Configuration module for filling input information previously reserved by modules ***DI_32***, ***DI_16*** or ***DI_8***. Care must be taken that the number of previously reserved input bits are sufficient to receive the existing input information of the configured I/O module (shown with a negative sign in brackets).	**75x-400* 2DI(-2 BIT I)**

Module	Description	Name example
DO_32	Configuration module for 32 digital outputs, 4 bytes are reserved in the output process image of the IO controller. The bit information in the first byte is allocated to the output data of the configured I/O module according to the number of existing signal channels. Remaining bit locations (shown with a positive signal in brackets) can be allocated to the signal conditions of the following digital I/O module using the same type of signal. This is carried out using the projection of ***DO_0*** modules for the relevant I/O modules.	**75x-504 4DO(+28 BIT O)**
DO_16	Configuration module for 16 digital outputs, 2 bytes are reserved in the output process image of the IO controller. The bit information in the first byte is allocated to the output data of the configured I/O module according to the number of existing signal channels. Remaining bit locations (shown with a positive signal in brackets) can be allocated to the signal states of the following digital output I/O modules having the same type of signal. This is done by configuring the ***DO_0*** modules of the relevant I/O modules.	**75x-504 4DO(+12 BIT O)**
DO_8	Configuration module for 8 digital outputs, 1 byte is reserved in the output process image of the IO controller. The bit information in the first byte is allocated to the output data of the configured I/O module according to the number of existing signal channels. Remaining bit locations (shown with a positive signal in brackets) can be allocated to the signal states of the following digital output I/O modules having the same type of signal. This is done by configuring the ***DO_0*** modules of the relevant I/O modules.	**75x-504 4DO(+4 BIT O)**
DO_0	Configuration module for filling input information previously reserved by modules ***DO_32, DO_*16** or ***DO_8.*** Care must be taken that the number of previously reserved output bits is sufficient to receive the existing output information of the configured I/O module (represented in brackets with a negative sign).	**75x-504* 4DO(-4 BIT O)**

Module	Description	Name example
DIO_32	Configuration module for 32 digital input and outputs, 4 bytes are reserved in the input and output process image of the IO controller. The bit information in the first byte each is allocated to the input and output data of the configured I/O module according to the number of existing signal channels. Remaining bit locations (shown with a positive signal in brackets) can be allocated to the signal states of the following digital input and/or output I/O modules having the same type of signal. This is done by configuring the ***DI_0***, ***DO_0*** or ***DIO_0*** modules of the relevant I/O modules.	**750-1502 8DIO(+24 BIT I/O)**
DIO_16	Configuration module for 16 digital input and outputs, 2 bytes are reserved in the input and output process image of the IO controller. The bit information in the first byte each is allocated to the input and output data of the configured I/O module according to the number of existing signal channels. Remaining bit locations (shown with a positive signal in brackets) can be allocated to the signal states of the following digital input and/or output I/O modules having the same type of signal. This is done by configuring the ***DI_0***, ***DO_0*** or ***DIO_0*** modules of the relevant I/O modules.	**750-1502 8DIO(+8 BIT I/O)**
DIO_8	Configuration module for 8 digital input and outputs, 1 byte is reserved in the input and output process image of the IO controller. The bit information is allocated to the input and output data of the configured I/O module according to the number of existing signal channels.	**750-1502 8DIO**
DIO_0	Configuration module for filling input and output information previously reserved by modules ***DIO_32***, ***DIO_16***, and ***DIO_8***. Care must be taken that the number of previously reserved input and output bits is sufficient to receive the existing input and output information of the configured I/O module (represented in brackets with a negative sign).	**750-1502* 8DIO(-8 BIT I/O)**

Digital I/O modules can deliver both process data as well as additional diagnostic information. Furthermore, they store the raw diagnostic data in the input process image via 4 additional configuration modules. Three modules of the respective input modules allocate 1, 2 or 4 bytes in the input image, 3 modules of the respective output modules reserve 1, 2 or 4 bytes in the input and output image. Respectively, 1 module of the I/O modules is used to fill previously reserved input and/or output areas. The 2 and 4 byte modules can be found in the hardware catalog under the sub-category “Word/Double Word Modules”.

Module	Description	Name example
DI_DIA_32	Configuration module for 32 digital inputs, 4 bytes are reserved in the input process image of the IO controller. The bit information in the first byte is allocated to the input and diagnostic data of the configured I/O module according to the number of existing signal channels. Remaining bit locations (shown in brackets with a positive sign) can be allocated to the signal states of the following I/O modules having the same type of signal. This is done by configuring the ***DI_0, DI_DIA_0*** or ***DO_DIA_0*** modules of the relevant I/O modules.	**75x-425 2DI(+28 BIT I), DIA in I-PI**
DI_DIA_16	Configuration module for 16 digital inputs, 2 bytes are reserved in the input process image of the IO controller. The bit information in the first byte is allocated to the input and diagnostic data of the configured I/O module according to the number of existing signal channels. Remaining bit locations (shown in brackets with a positive sign) can be allocated to the signal states of the following I/O modules having the same type of signal. This is done by configuring the ***DI_0, DI_DIA_0*** or ***DO_DIA_0*** modules of the relevant I/O modules.	**75x-425 2DI(+12 BIT I), DIA in I-PI**
DI_DIA_8	Configuration module for 8 digital inputs, 1 byte is reserved in the input process image of the IO controller. The existing bit information in the first byte is allocated to the input and diagnostic data of the configured I/O module according to the respective number of existing signal channels. Remaining bit locations (shown in brackets with a positive sign) can be allocated to the signal states of the following I/O modules having the same type of signal. This is done by configuring the ***DI_0, DI_DIA_0*** or ***DO_DIA_0*** modules of the relevant I/O modules.	**75x-425 2DI(+4 BIT I), DIA in I-PI**
DI_DIA_0	Configuration module for filling input information previously reserved by modules ***DI_32, DI_DIA_32, DI_16, DI_DIA_16, DI_8*** or ***DI_DIA_8.*** Care must be taken that the number of previously reserved input bits is sufficient to receive the existing input and diagnostic information of the configured I/O module (represented in brackets with a negative sign).	**75x-425* 2DI(-4 BIT I), DIA in I-PI**

Module	Description	Name example
DO_DIA_32	Configuration module for 32 digital inputs and outputs, 4 bytes are reserved in the input and output process image of the IO controller. The bit information in the first byte of the output area is allocated to the output data of the configured I/O module according to the number of existing signal channels. The bit information in the first byte of the input area is allocated to the raw diagnostic data of the individual signal channels. Remaining bit locations of the reserved input and output area (indicated in brackets with a positive sign) can be allocated to the signal conditions of the following digital I/O modules having the same type of signal. This is done by configuring the ***Dx_0*** or ***Dx_DIA_0*** modules of the relevant I/O modules.	**75x-507 2DO(+30 BIT I/O), DIA in I-PI**
DO_DIA_16	Configuration module for 16 digital inputs and outputs, 2 bytes are reserved in the input and output process image of the IO controller. The bit information in the first byte of the output area is allocated to the output data of the configured I/O module according to the number of existing signal channels. The bit information in the first byte of the input area is allocated to the raw diagnostic data of the individual signal channels. Remaining bit locations of the reserved input and output area (indicated in brackets with a positive sign) can be allocated to the signal conditions of the following digital I/O modules having the same type of signal. This is done by configuring the ***Dx_0*** or ***Dx_DIA_0*** modules of the relevant I/O modules.	**75x-507 2DO(+14 BIT I/O), DIA in I-PI**
DO_DIA_8	Configuration module for 8 digital inputs and outputs, 1 byte is reserved in the input and output process image of the IO controller. The bit information of the output area is allocated to the output data of the configured I/O module according to the number of existing signal channels. The bit information of the input area is allocated to the raw diagnostic data of the individual signal channels. Remaining bit locations of the reserved input and output area (indicated in brackets with a positive sign) can be allocated to the signal conditions of the following digital I/O modules having the same type of signal. This is done by configuring the ***Dx_0*** or ***Dx_DIA_0*** modules of the relevant I/O modules.	**75x-507 2DO(+6 BIT I/O), DIA in I-PI**

Module	Description	Name example
DO_DIA_0	Configuration module for filling input and output information previously reserved by modules ***Dx_32, Dx_DIA_32, Dx_16, Dx_DIA_16, Dx_8*** or ***Dx_DIA_8***. Care must be taken that the number of previously reserved input and output bits are sufficient to receive the existing output and diagnostic information of the configured I/O module (represented in brackets with negative sign).	**75x-507* 2DO(-2 BIT I/O), DIA in I-PI**

3.1.3.2.2 Configuring Analog I/O Modules

Two configuration modules are available for configuring analog input and output modules. The first module supplies the user data in the respective input or output process image. The second module that is provided with EM (Extended Mapping) as module description extension, supplies all existing data including control and status information in the input and output areas. These modules make it possible to access the register structure of the I/O modules in productive data exchange, so that, e.g., the operating parameters can be modified.

Module	Description	Exemplary Marking
AI	Configuration module for analog input modules. Each channel provides 1 word (2 bytes) of data in the input process image of the IO controller.	**75x-467 2AI, 0-10 V**
AI_EM	Configuration module for analog input modules. Each signal channel provides a structure of 1 byte status and 1 word (2 bytes) of data in the input process image and a structure of 1 byte control and 1 word (2 bytes) of data in the output process image of the IO controller. The data in the output area of the I/O module does not have any significance during normal operation.	**75x-467 2AI, 0-10 V, EM**
AO	Configuration module for analog output modules. Each channel provides 1 word (2 bytes) of data in the output process image of the IO controller.	**75x-550 2AO, 0-10 V**

Module	Description	Exemplary Marking
AO_EM	Configuration module for analog output modules. Each signal channel provides a structure of 1 byte control and 1 word (2 bytes) of data in the output process image and a structure of 1 byte status and 1 word (2 bytes) of data in the input process image of the IO controller. During standard operation, the status byte optionally provides the IO controller with information of the upcoming faults. The data in the input area of the I/O module does not have any significance with this type of operation.	**75x-550 2AO, 0-10 V, EM**

3.1.3.2.3 Configuring Specialty Modules

One configuration module is available for configuring all speciality modules such as counter, PWM, encoder and serial interfaces that provides all information of the respective I/O module in the input and output process images. These modules make it possible to access the register structure of the I/O module in the productive data exchange so that, e.g., the operating parameters can be modified. The structure of the process image is specific to the modules and can be obtained from the respective I/O module documentation. The I/O modules 750-511 and 750-630 are an exception as they have two configuration modules.

Module	Description	Marking
PWM	Configuration module for pulse width output module. Each channel provides 1 word (2 bytes) of data in the output process image of the IO controller.	**75x-511 2PWM**
PWM_EM	Configuration module for pulse width output module. Each signal channel provides a structure of 1 byte control and 1 word (2 bytes) of data in the output process image and a structure of 1 byte status and 1 word (2 bytes) of data in the input process image of the IO controller. Depending on the operating mode selected, process information is also carried by the input data in productive data exchange.	**75x-511 2PWM, EM**
SSI	Configuration module for SSI interface. 1 double word (4 bytes) of data is provided in the input process image of the IO controller.	**75x-630 1SSI**
SSI_EM	Configuration module for SSI interface. A structure of 1 byte status and 1 double word (4 bytes) of data are provided in the input process image, a structure of 1 byte control and 1 double word (4 bytes) of data are provided in the output process image of the IO controller. The status byte supplies the information for the upcoming faults in the productive data exchange. The productive data exchange does not have any significance in the output area of the I/O module.	**75x-630 1SSI, EM**

3.1.3.2.4 Configuring System modules

Five configuration modules are available for the diagnostic capable field side supply modules. Four of these modules provide the diagnostic information in the input process image.

Module	Description	Exemplary name
PE_DIA_32	Configuration module for 32 digital inputs, 4 bytes are reserved in the input process image of the IO controller. The bit information in the first byte is allocated to the 2 bit diagnostic data of the configured supply module. Remaining bit locations (indicated in brackets with a positive sign) can be allocated to the signal states of the following I/O module having the appropriate type of signal or the diagnostic information of diagnostic capable I/O modules. This is done by configuring the ***DI_0, DI_DIA_0, DO_DIA_0*** or ***PE_DIA_0*** modules for the relevant I/O modules.	**750-610 Supply, 2DIA(+30 BIT I), DIA in I-PI**
PE_DIA_16	Configuration module for 16 digital inputs, 2 bytes are reserved in the input process image of the IO controller. The bit information in the first byte is allocated to the 2 bit diagnostic data of the configured supply module. Remaining bit locations (indicated in brackets with a positive sign) can be allocated to the signal states of the following I/O module having the appropriate type of signal or the diagnostic information of diagnostic capable I/O modules. This is done by configuring the ***DI_0, DI_DIA_0, DO_DIA_0*** or ***PE_DIA_0*** modules for the relevant I/O modules.	**750-610 Supply, 2DIA(+14 BIT I), DIA in I-PI**
PE_DIA_8	Configuration module for 8 digital inputs, 1 byte is reserved in the input process image of the IO controller. 2 bit are allocated to the diagnostic data of the configured supply module. Remaining bit locations (indicated in brackets with a positive sign) can be allocated to the signal states of the following I/O module having the appropriate type of signal or the diagnostic information of diagnostic capable I/O modules. This is done by configuring the ***DI_0, DI_DIA_0, DO_DIA_0*** or ***PE_DIA_0*** modules for the relevant I/O modules.	**750-610 Supply, 2DIA(+6 BIT I), DIA in I-PI**

Module	Description	Exemplary name
PE_DIA_0	Configuration module for filling input information previously reserved by modules ***DI_32, PE_DIA_32, Dx_DIA_32, DI_16, PE_DIA_16, Dx_DIA_16, DI_8, PE_DIA_8*** or ***Dx_DIA_8***. Care must be taken that the number of previously reserved input and output bits are sufficient to receive 2 bit diagnostic information of the configured I/O module (represented in brackets with a negative sign).	**750-610* Supply, 2DIA(-2 BIT I), DIA in I-PI**
DIA_0	The 2 bit diagnostic information is not available in the input process image of the IO controller. They are made available in the form of channel diagnostics via the corresponding data set and also transmitted via diagnostic alarms.	**750-610 Supply, DIA**

3.1.3.3 Parameter Setting

3.1.3.3.1 Station Parameters

The parameters of the station substitute are used to set the overall settings of the PROFINET IO node. Some of the settings are used in the modules as default settings and can be optionally overwritten within the module configuration.

Parameter	Setting	Description
Restart on K-Bus failure		Restart of the internal data bus following a fault, such as, for example, no end module following:
	POWER ON RESET*)	after an interruption of the buscoupler supply
	AUTORESET	immediately after overcoming the internal bus fault
Internal data bus extension		Use of the internal data bus extension
	EEPROM setting is used*)	is based upon the settings in EEPROM that are made using the “WAGO Extension Settings” tool.
	is not used	is excluded
	is used	is possible
Diagnostics of external module / channel errors		The external diagnostic information of all diagnostics capable I/O modules are:
	disabled	not transferred to the PROFINET IO controller
	enabled*)	transferred to the PROFINET IO controller

Parameter	Setting	Description
Process data representation		Word or double word orientated process data are transfered to the PROFINET IO controller in:
	INTEL (LSB-MSB)	“Little Endian” format
	MOTOROLA (MSB-LSB)*)	“Big Endian” format
Response to PROFINET IO failure		In the case of a malfunction of the PROFINET IO communication, the status of the connected output periphery can be influenced in various ways.
	K-Bus transmission is stopped	The process data exchange on the internal bus is stopped, all outputs drop out after a module specific monitoring time of 100 ms.
	Output image is cleared	All outputs are immediately reset.
	Output image is stored	All outputs maintain the last status before the malfunction.
	Substitute values are switched*)	All outputs switch the substitute value configured when designing the module.
Response to K-Bus failure		In the event of a malfunction of an internal communication between fieldbus controller and I/O modules, such as, for example no end module.
	PROFINET IO communication is stopped *)	Separates the cyclic connection to the PROFINET IO controller.
	Input image is cleared	The input information of the respective periphery module is set to zero.
	Input image is stored	The input information of the periphery module prevailing before the fault is maintained.
	*) Default settings	

3.1.3.3.2 Standard Module Parameters

Certain characteristics of some I/O modules can be parameterized during the configuration. At present, this only applies to the output modules whose substitute value behavior can be set independent of the modules used.

Parameter	Setting	Description
Substitute value behavior of outputs		In case the IO controller does not supply valid output data for the I/O module or the group of I/O modules then
	according to device settings*)	the substitute strategy on the side of the station proxy applies (IO device).
	according to referenced module settings*)1)	the substitute strategy on the side of the referenced digital output module by which the output data has been reserved. These settings apply to digital output modules without process data. These are characterized using a * behind the item number.
	Outputs are set to zero	all outputs are immediately reset
	Outputs are set to last valid states	all outputs maintain the last valid state
	Outputs are set to substitute states	all outputs switch to their configured substitute state
	*) Presetting	
	1) Digital modules whose process data has been allocated to their previous slots implicitly take over the substitute value strategy of the module on the slot allocated.	

3.1.3.3.3 Failsafe Module Parameters (F-Parameters)

Failsafe I/O modules require the standardized PROFIsafe configuration to ensure a safe exchange of productive data.

Parameter	Setting	Description
F_Check_iPar	NoCheck[*1)]	There are no individual parameters contained in the F-parameters that have to be checked.
F_SIL	SIL3[*1)]	The module complies with the safety integrity level of catagory 3.
F_CRC_Length	3-Byte-CRC[*1)]	The productive data transfer is safeguarded using a 3 byte CRC in case of PROFINET IO.
F_Par_Version	1[*1)]	The version of the parameters set structure is 1.
F_Source_Add	1 ... 65534	The F-Source address addresses the F-Host.
F_Dest_Add	1 ... 1023 (65534[*3)])	The F-Target address addresses the F-Device.
F_WD_Time	150[*2)] 1 ... 10000	The F-Watchdog monitors the data exchange between the F-Host and F-Device. The settings are carried out in milliseconds.
F_iPar_CRC[*4)]	0[*2)] ... 4294967295	Signature, of the actual in the module used individual parameter set, which is necessary for using the iParameter server.
	[*1)] Fixed settings	
	[*2)] Presettings	
	[*3)] only for F-modules 75x-66x/000-003 via software	
	[*4)] only for F-modules 75x-66x/000-003 using iParameter server	

3.1.3.3.4 General Channel Parameters

Individual settings of the channel characteristics can be performed when designing several I/O modules. The following channel specific settings can be made depending on the I/O module:

Parameter	Setting	Description
Asynch. diagnostic message channel x		With external faults, channel diagnostics and the respective alarms are
	disabled*)	not transferred to the IO controller
	enabled	transferred to the IO controller
Process data representation channel x		Word or double word orientated process data of the signal channel are transferred to the IO controller in:
	according to device settings*)	format that is set on the side of the station proxy
	INTEL (LSB-MSB)	“Little Endian” format
	MOTOROLA (MSB-LSB)	“Big Endian” format
Output substitute value channel x	I/O module specific 0x0000*) ... 0xFFFF	When configuring the substitute value behavior on the side of the I/O module, these values are transmitted to the complex signal channel with invalid output data of the IO controller.
Output substitute state channel x	0*) ... 1	When configuring the substitute value behavior on the side of the I/O module, these values are transmitted to the binary signal channel with invalid output states of the IO controller.
	*) Default settings	

3.1.3.3.5 Specific Channel parameters

Some I/O modules have specific channel parameters additionally to general channel parameters. This I/O modules are at present:

75x-464, 75x-464/020-000,

75x-562, 75x-563,

75x-644, 75x-655, 75x-670, 75x-671, 750-672, 75x-673

The description of the specific parameters of the above mentioned I/O modules can be found in chapter “5.3, Configuration and Parameter Settings of the ”.

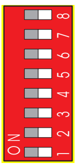
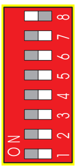
3.1.3.4 Station Naming

3.1.3.4.1 Device Name Assignment via Configuration Tool

The fieldbus coupler (IO device) can be clearly identified using its device name within a PROFINET IO network. The device name enables the IO controller to allocate the device with an IP address, subnet mask, and standard gateway for establishing the productive data exchange when starting the system. The IO device receives the device name during configuration (station naming) and stores it permanently. The device name is transferred using the **D**iscovery and basic **C**onfiguration-**P**rotocol (DCP). The device is activated using the Ethernet address (MAC address).

3.1.3.4.2 Device Name Assignment via DIP Switch Settings

In addition to assigning a name via a configuration tool, a device name instance based on the `"wago 750 370"` or `"wagox750x370"` specified strings can be allocated to the device via the DIP switch setting. This kind of station naming is enabled by setting switch 8 to "ON". Selecting the desired string is performed via switch 7. The device name instance is constructed using the following rule:

Station naming method	**Switch/Value**							**Resulting device name**
	7	**6**	**5**	**4**	**3**	**2**	**1**	
	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
 **E^2PROM**	Not relevant							The name assigned via DCP is recorded from E2PROM. When reassigning a name, the name is stored in E2PROM (condition upon delivery)
 **Switch**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	„wago-750-370“
	OFF	OFF	OFF	OFF	OFF	OFF	ON	„wago-750-370-1“
	OFF	OFF	OFF	OFF	OFF	ON	OFF	„wago-750-370-2“
	. . .							. . .
	OFF	ON	ON	ON	ON	ON	ON	„wago-750-370-63“
	ON	OFF	OFF	OFF	OFF	OFF	OFF	„wagox750x370“
	ON	OFF	OFF	OFF	OFF	OFF	ON	„wagox750x370x1“
	ON	OFF	OFF	OFF	OFF	ON	OFF	„wagox750x370x2“
	. . .							. . .
	ON	ON	ON	ON	ON	ON	ON	„wagox750x370x63“

3.1.4 Initialization Phase of the Fieldbus Coupler

The communication system can be commissioned after the PROFINET IO system has been configured, the IO devices have been installed and a name has been given to the station.

After the power supply has been switched on, the fieldbus coupler initializes the internal communication system. In the phase where the I/O LED flashes red with 10 Hz, the arranged I/O modules are determined and are allocated to the PROFINET IO process image according to the standard defaults of the bus coupler. After a trouble free start that is displayed using a green lit “I/O” LED, the coupler changes to the condition “Fieldbus start” where it then waits for the connection build-up of the IO controller. If the coupler startup procedure was not carried out successfully, the red I/O LED signals the cause of failure through a flashing cycle. The cause of failures can be obtained in chapter 3.1.12.1.

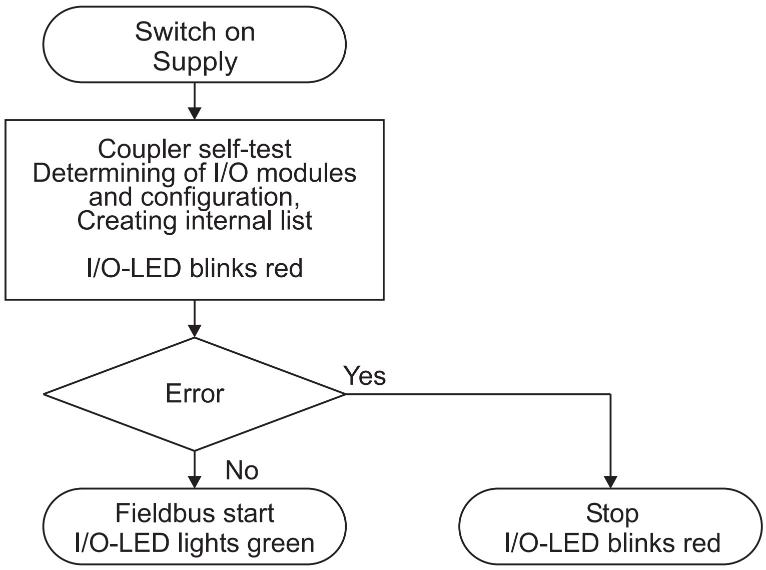


Fig. 3.1.4-6: Initialization phase g012113e

3.1.5 Process Image

3.1.5.1 Local Process Image

After being switched on, the coupler identifies all I/O modules connected that supply or receive process data (data width or bit width > 0).

Note
For the number of input and output bits or bytes of the individual I/O modules please refer to the corresponding description of the I/O modules.

The fieldbus coupler allocates the user data of the connected I/O modules according to specified rules to the local input and output image. The allocation is carried out according to the slots. Digital I/O modules with a data width less than 8 bits are always opened with one bit in the respective process image area.

After a successful configuration test while establishing the connection, if there is any difference between the user configuration and the process image generated during start up, a new process image is created according to the user configuration. One of the reasons for this may be the packing of digital I/O modules or the lack of configuration modules for the connected I/O modules during configuration.

3.1.5.2 Allocation of the Input and Output Data

The process data is exchanged via the PROFINET IO using the higher ranking controls. A maximum of 320 bytes of output data (including all IOPS and IOCS) can be transferred from the IO controller to the bus coupler. The bus coupler sends a maximum of 320 byte of input data (including all IOPS and IOCS) to the IO controller.

When configuring a node, the individual modules are configured in accordance with their physical arrangement (slot orientated). These modules can be taken over from a hardware catalog of the configuration tool. All specific information on the relevant modules is contained in the associated GSD file.

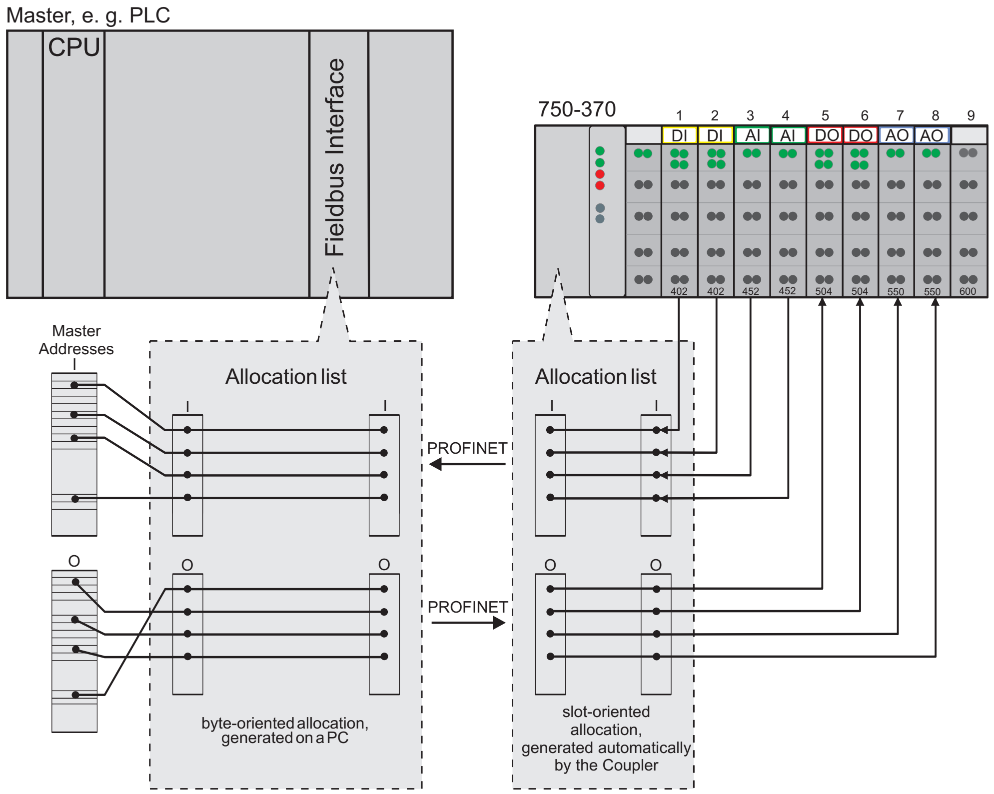


Fig. 3.1.5-7: Allocation of the input and output data g037003e

In productive data exchange, one or two byte IOXS process data qualifiers are available for each configuration module providing information of the validity of the module data. The process data qualifiers are an integral part of the maximum length of 320 bytes in each process image area and must therefore be considered when mounting the modules.

3.1.5.2.1 Digital Input Modules

The group of digital input I/O modules is divided into eight types of modules:

Type of module	Description	Substitute I/O modules
2DI	2-Channel Digital Input Modules	75x-400, 75x-401, 75x-405, 75x-406, 75x-410, 75x-411, 75x-412, 75x-413, 75x-416, 75x-427, 75x-429, 75x-435, 75x-438
2DI_2DIA	2-Channel Digital Input Modules 1 bit diagnostic per channel	75x-419, 75x-421, 75x-425
2DI_2DIA_PI	2-Channel Digital Input Modules 1 Bit diagnostic per channel, additional diagnostic in the input image	
2DI_2DIA_2ACK	2-Channel Digital Input Modules 1 bit diagnostic and 1 bit diag-nostic confirmation per channel	75x-418
2DI_2DIA_2ACK_PI	2-Channel Digital Input Modules 1 bit diagnostic and 1 bit diag-nostic confirmation per channel, with additional diagnostics in the input image	
4DI	4-Channel Digital Input Modules	75x-402, 75x-403, 75x-408, 75x-409, 75x-414, 75x-415, 75x-422, 75x-423, 75x-424, 75x-428, 75x-432, 75x-433, 75x-440, 75x-1420, 75x-1421, 75x-1422, 75x-1423
8DI	8-Channel Digital Input Modules	75x-430, 75x-431, 75x-434, 75x-436, 75x-437, 75x-1415, 75x-1416, 75x-1417, 75x-1418
16DI	16-Channel Digital Input Modules	750-1400, 750-1402, 75x-1405 75x-1406, 75x-1407, 75x-1408

Digital input modules receive the consumer status (IOCS) from the IO controller and supply it with the provider status (IOPS) of the available input and optional existing diagnostic information.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PI) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Type \ Module	750-(1)4xx ...						750-(1)4xx* ...					
	Data length / [Byte]				Data type		Data length / [Byte]				Data type	
	PI		TLG		I	O	PI		TLG		I	O
	I	O	Tx	Rx			I	O	Tx	Rx		
2DI	1	0	2	1	UINT8	-	0	0	1	1	-	-
	2	0	3	1	UINT16	-						
	4	0	5	1	UINT32	-						
2DI_2DIA **2DI_2DIA_PI**	1	0	2	1	UINT8	-	0	0	1	1	-	-
	2	0	3	1	UINT16	-						
	4	0	5	1	UINT32	-						
2DI_2DIA_2ACK **2DI_2DIA_2ACK_PI**	1	1	3	3	UINT8	UINT8	0	0	2	2	-	-
	1	1	2	2	UINT16	UINT16						
	1	1	2	2	UINT32	UINT32						
4DI	1	0	2	1	UINT8	-	0	0	1	1	-	-
	2	0	3	1	UINT16	-						
	4	0	5	1	UINT32	-						
8DI	1	0	2	1	UINT8	-						
	2	0	3	1	UINT8	-	0	0	1	1	-	-
	4	0	5	1	UINT8	-						
16DI	2	0	3	1	UINT16	-						
	4	0	5	1	UINT32	-	0	0	1	1	-	-

3.1.5.2.2 Digital Output Modules

The group of digital output I/O modules is divided into twelve types of module types:

Type of module	Description	Substitute I/O modules
2DO	2-Channel Digital Output Modules	75x-501, 75x-502, 75x-509, 75x-512, 75x-513, 75x-514, 75x-517, 75x-535
2DI_2DIA	2-Channel Digital Output Modules 1 bit diagnostics per signal channel	75x-507, 75x-508, 75x-522, 75x-523
2DI_2DIA_PI	2-Channel Digital Output Modules 1 bit diagnostics per signal channel, additional diagnostics in the input image	
2DI_4DIA	2-Channel Digital Output Modules 2 bit diagnostics per signal channel	75x-506
2DI_4DIA_PI	2-Channel Digital Output Modules 2 bit diagnostics per signal channel, additional diagnostics in the input image	
4DO	4-Channel Digital Output Modules	75x-504, 75x-516, 75x-519 75x-531, 75x-540
4DO_4DIA	4-Channel Digital Output Modules 1 bit diagnostics per signal channel	75x-532
4DO_4DIA_PI	4-Channel Digital Output Modules 1 bit diagnostics per signal channel, additional diagnostics in the input image	
8DO	8-Channel Digital Outut Modules	75x-530, 75x-534, 75x-536, 75x-1515, 75x-1516
8DO_8DIA	8-Channel Digital Output Modules 1 bit diagnostics per signal channel	75x-537
8DO_8DIA_PI	8-Channel Digital Output Modules 1 bit diagnostics per signal channel, additional diagnostics in the input image	
16DO	16-Channel Digital Output Modules	750-1500, 750-1501, 75x-1504, 75x-1505

Digital output modules without diagnostics in the input process image receive the provider status (IOPS) from the IO controller and supply it with the consumer status (IOCS) of existing output information. The accompanying process data is additionally transmitted in the opposite direction in case the corresponding diagnostics of the module appears in the input image of the IO controller.

The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-(1)5xx ...						75x-(1)5xx* ...					
	Data length / [Byte]				Data type		Data length / [Byte]				Datea type	
	PI		TLG		I	O	PI		TLG		I	O
	I	O	Tx	Rx			I	O	Tx	Rx		
2DO	0	1	1	2	-	UINT8	0	0	1	1	-	-
	0	2	1	3	-	UINT16						
	0	4	1	5	-	UINT32						
2DO_2DIA	0	1	1	2	-	UINT8	0	0	1	1	-	-
	0	2	1	3	-	UINT16						
	0	4	1	5	-	UINT32						
2DO_2DIA_PI	1	1	3	3	UINT8	UINT8	0	0	1	1	-	-
	2	2	4	4	UINT16	UINT16						
	4	4	6	6	UINT32	UINT32						
2DO_4DIA	0	1	1	2	-	UINT8	0	0	1	1	-	-
	0	2	1	3	-	UINT16						
	0	4	1	5	-	UINT32						
2DO_4DIA_PI	1	1	3	3	UINT8	UINT8	0	0	1	1	-	-
	2	2	4	4	UINT16	UINT16						
	4	4	6	6	UINT32	UINT32						
4DO	0	1	1	2	-	UINT8	0	0	1	1	-	-
	0	2	1	3	-	UINT16						
	0	4	1	5	-	UINT32						
4DO_4DIA	0	1	1	2	-	UINT8	0	0	1	1	-	-
	0	2	1	3	-	UINT16						
	0	4	1	5	-	UINT32						
4DO_4DIA_PI	1	1	3	3	UINT8	UINT8	0	0	1	1	-	-
	2	2	4	4	UINT16	UINT16						
	4	4	6	6	UINT32	UINT32						
8DO	0	1	1	2	-	UINT8						
	0	2	1	3	-	UINT16	0	0	1	1	-	-
	0	4	1	5	-	UINT32						
8DO_8DIA	0	1	1	2	-	UINT8						
	0	2	1	3	-	UINT16	0	0	1	1	-	-
	0	4	1	5	-	UINT32						
8DO_8DIA_PI	1	1	3	3	UINT8	UINT8						
	2	2	4	4	UINT16	UINT16	0	0	1	1	-	-
	4	4	6	6	UINT32	UINT32						
16DO	0	2	1	3	-	UINT16						
	0	4	1	5	-	UINT32	0	0	1	1	-	-

3.1.5.2.3 Digital Input/Output Modules

For the digital input/output modules, there is one module type:

Type of module	Description	Substitute I/O modules
8DIO	8-Channel Digital Input/Output Modules	75x-1506

Digital input/output modules receive the provider status (IOPS) of the available output information as well as the consumer status (IOCS) of the received input information from the IO controller. They provide the IO controller with the consumer status (IOCS) of the received output information as well as the provider status of the available input information.

The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-1506						75x-1506*					
	Data length / [Byte]				Data type		Data length / [Byte]				Data type	
	PI		TLG		I	O	PI		TLG		I	O
	I	O	Tx	Rx			I	O	Tx	Rx		
8DIO	1	1	3	3	UINT8	UINT8						
	2	2	4	4	UINT16	UINT16	0	0	1	1	-	-
	4	4	6	6	UINT32	UINT32						

3.1.5.2.4 Analog Input Modules

The group of analog input modules is divided into five types of modules:

Type of module	Description	Substitute I/O modules
2AI	2-Channel Analog Input Modules, 16 bit input data per signal channel	75x-452, 75x-454, 75x-456, 75x-461, 75x-462, 75x-464, 75x-465,75x-466, 75x-467, 75x-469, 75x-470, 75x-472, 75x-473, 75x-474, 75x-475, 75x-476, 75x-477, 75x-478, 75x-479, 75x-480, 75x-481, 75x-483, 75x-485, 75x-487, 75x-491, 75x-492
2AI_EM	2-Channel Analog Input Modules, 16 bit input and output data plus control and status byte per signal channel, access to the register structure using cyclic data exchange	
3AI_EM	3-Channel Analog Input Modules, 16 bit input and output data plus control and status byte per signal channel, access to the register structure using cyclic data exchange	75x-493
4AI	4-Channel Analog Input Modules, 16 bit input data per signal channel	75x-453, 75x-455, 75x-457, 75x-459, 75x-460, 75x-464, 75x-468
4AI_EM	4-Channel Analog Input Modules, 16 bit input and output data plus control and status byte per signal channel, access to the register structure using cyclic data exchange	

Analog input modules receive the consumer status (IOCS) from the IO controller and supply it with the provider status (IOPS) of the existing input information in case only the actual user data is replaced. If all existing information in the input and output image is made available, then the process data qualifier is additionally transmitted in the opposite direction.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-4xx nAI, …							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
2AI	4	-	5	1	INT16	2	-	-
4AI	8	-	9	1	INT16	4	-	-

Module / Type	75x-4xx nAI, …, EM							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
2AI_EM	6	6	8	8	INT16	2	INT16	2
3AI_EM	12	12	14	14	UINT8 [2], INT16	3	UINT8[2], INT16	3
4AI_EM	12	12	14	14	UINT8,UINT16	4	UINT8,UINT16	4

3.1.5.2.5 Analog Output Modules

The group of analog output modules is divided into four types of modules:

Type of module	Description	Substitute I/O modules
2AO	2-Channel Analog Output Modules, 16 Bit output data per signal channel	75x-550, 75x-552, 75x-554, 75x-556, 75x-560, 75x-562, 75x-563, 75x-585
2AO_EM	2-Channel Analog Output Modules, 16 Bit input and output data plus control and status byte per signal channel, access to the register structure using cyclic data exchange	
4AO	4-Channel Analog Output Modules, 16-Bit output data per signal channel	75x-553, 75x-555, 75x-557, 75x-559
4AO_EM	4-Channel Analog Output Modules, 16 Bit input and output data plus control and status byte per signal channel, access to the register structure using cyclic data exchange	

Analog output modules receive the consumer status (IOCS) from the IO controller and supply it with the provider status (IOPS) of the existing output information in case only the actual user data is exchanged. If all existing information in the input and output image is made available, then the process data qualifier is additionally transmitted in the opposite direction.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-5xx nAO, …							
	Data lenght [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
2AO	4	-	1	5	-	-	INT16	2
4AO	8	-	1	9	-	-	INT16	4

Module / Type	75x-5xx nAO, …							
	Data lenght [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
2AO_EM	6	6	8	8	UINT8,INT16	2	UINT8,INT16	2
4AO_EM	12	12	14	14	UINT8,INT16	4	UINT8,INT16	4

3.1.5.2.6 Special Modules

3.1.5.2.6.1 Up/Down Counter

The group of counters is divided into two types of modules:

Type of module	Description	Substitute I/O modules
1CNT	1 (2)-Channel Up/Down Counter, 32 (16) Bit input and output data plus control and status byte per signal channel, access to the register structure using cyclic data exchange	75x-404
2CNT	2-Channel Up/Down Counter, 16 Bit input and output data plus control and status byte per signal channel, access to the register structure using cyclic data exchange	75x-638

The provider and consumer status (IOPS) of the input or output information are exchanged between the IO controller and IO device in both directions with counters.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

<table>
<tr><th rowspan="4">Module / Type</th><th colspan="8">75x-404 1CNT / 75x-638 2CNT</th></tr>
<tr><th colspan="4">Data length [Byte]</th><th colspan="4">Data object</th></tr>
<tr><th colspan="2">PI</th><th colspan="2">TLG</th><th rowspan="2">I</th><th rowspan="2">INST</th><th rowspan="2">O</th><th rowspan="2">INST</th></tr>
<tr><th>I</th><th>O</th><th>Tx</th><th>Rx</th></tr>
<tr><td>1CNT</td><td>6</td><td>6</td><td>8</td><td>8</td><td>UINT8[2], UINT32</td><td>1</td><td>UINT8[2], UINT32</td><td>1</td></tr>
<tr><td>2CNT</td><td>6</td><td>6</td><td>8</td><td>8</td><td>UINT8,UINT16</td><td>2</td><td>UINT8,UINT16</td><td>2</td></tr>
</table>

3.1.5.2.6.2 2-Channel Pulse Width Output Module

For the 2-Channel Pulse Width Output Module, there are two module types:

Type of module	Description	Substitute I/O modules
PWM	2-Channel Pulse Width Output Module, 16bit output data per signal channel	75x-511
PWM_EM	2-Channel Pulse Width Output Module, 16 bit input and output data plus control and status byte per signal channel, access to the register structure using cyclic data exchange	

PWM output modules receive the consumer status (IOCS) from the IO controller and supply it with the provider status (IOPS) of the existing output information in case only the actual user data is replaced. If all existing information in the input and output image is made available, then the process data qualifier is additionally transmitted in the opposite direction.

The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-511 2PWM							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
PWM	-	4	1	5	-	-	INT16	2

Module / Type	75x-511 2PWM, EM							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
PWM_EM	6	6	8	8	UINT8,INT16	2	UINT8,INT16	2

3.1.5.2.6.3 Distance and Angle Measurement Modules

The group of distance and angle measurement modules is divided into four module types:

Type of module	Description	Substitute I/O modules
SSI	SSI Interface, 32 bit input data	75x-630
SSI_EM	SSI Interface, 32 bit input and output data plus control and status byte, access to the register structure using cyclic data exchange	
ENC	Encoder Interface, 32 bit input and output data plus control and status byte, access to the register structure using cyclic data exchange	75x-631, 75x-634, 75x-637
DII	Digital Impulse Interface, 24 bit input and output data plus control and status byte, access to the register structure using cyclic data exchange	75x-635

The provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions for distance and angle measurement modules. With the SSI Interface 75x630, there is also an additional possibility for exclusively transmitting the input data of the transmitter. In this case, the IO device only receives the consumer status (IOCS) from the IO controller and supplies it with the provider status (IOPS) of the input data provided.

The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-630 SSI							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
SSI	4	0	5	1	UINT32	1	-	-

Module / Typ	75x-630 SSI, EM / 75x-63x …							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
SSI_EM	6	6	8	8	UINT8,UINT32	1	UINT8,UINT32	1
ENC	6	6	8	8	UINT8, UINT16	2	UINT8,UINT16	2
DII	4	4	6	6	UINT8, UINT8[3]	1	UINT8,UINT[3]	1

3.1.5.2.6.4 Serial Interfaces

The group of serial interfaces is divided into six types of modules:

Type of module	Description	Substitute I/O modules
SER_5D	Serial Interface	75x-650, 75x-651, 75x-653
SER_6D	Multi-Protocol Serial Interface	75x-652
SER_22D		
SER_46D		
DXH	Data Exchange Module	75x-654
DXH_EM	Data Exchange Module, access to the register structure via cyclic data exchange	

The provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions with serial interfaces.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-650 RS 232 C / 75x-651 RS 485 / 75x-652 RS 232, RS485 / 75x-653 TTY / 75x-654 DXCH							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
SER_5D	6	6	8	8	UINT8, UINT8[5]	1	UINT8, UINT8[5]	1
SER_6D	8	8	10	10	UINT8[2], UINT8[6]	1	UINT8[2], UINT8[6]	1
SER_22D	24	24	26	26	UINT8[2], UINT8[22]	1	UINT8[2], UINT8[22]	1
SER_46D	48	48	50	50	UINT8[2], UINT8[46]	1	UINT8[2], UINT8[46]	1
DXH	4	4	6	6	UINT8[4]	1	UINT8[4]	1
DXH_EM	6	6	8	8	UINT8, UINT8[5]	1	UINT8, UINT8[5]	1

3.1.5.2.6.5 KNX/EIB/TP1 Module

For the KNX/EIB/TP1 Module, there is one module type:

Type of module	Description	Substitute I/O modules
KNX	KNX/EIB/TP1 Module	75x-646

With the KNX/EIB/TP1 Module, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.

The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-646 KNX/EIB/TP1							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
KNX	24	24	26	26	UINT8, UINT8[23]	1	UINT8, UINT8[23]	1

3.1.5.2.6.6 DALI/DSI Master Module

For the DALI/DSI Master Module, there is one module type:

Type of module	Description	Substitute I/O modules
DALI	DALI/DSI Master Module	75x-641

With the DALI/DSI Master Module, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-641 DALI/DSI							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
DALI	6	6	8	8	UINT8, UINT8[5]	1	UINT8, UINT8[5]	1

3.1.5.2.6.7 AS-Interface Master

For the AS-Interface Master Module, there are six module types:

Type of module	Description	Substitute I/O modules
ASI_10D	AS-Interface Master	75x-655
ASI_18D		
ASI_22D		
ASI_30D		
ASI_38D		
ASI_46D		

With the AS-Interface Master, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-655 ASI_xxD							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
ASI_10D	12	12	14	14	UINT8[2], UINT8[10]	1	UINT8[2], UINT8[10]	1
ASI_18D	20	20	22	22	UINT8[2], UINT8[18]	1	UINT8[2], UINT8[18]	1
ASI_22D	24	24	26	26	UINT8[2], UINT8[22]	1	UINT8[2], UINT8[22]	1
ASI_30D	32	32	34	34	UINT8[2], UINT8[30]	1	UINT8[2], UINT8[30]	1
ASI_38D	40	40	42	42	UINT8[2], UINT8[38]	1	UINT8[2], UINT8[38]	1
ASI_46D	48	48	50	50	UINT8[2], UINT8[46]	1	UINT8[2], UINT8[46]	1

3.1.5.2.6.8 RF-Modules

For the RF-Modules, there are four module types:

Type of module	Description	Substitute I/O modules
ENOC	Radio Receiver Module	75x-642
BT_10D	*Bluetooth*® RF-Transceiver	750-644
BT_22D		
BT_46D		

For the RF-Modules, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-642 RF-RCV EnOcean / 750-644 Bluetooth							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
ENOC	4	4	6	6	UINT8, UINT8[3]	1	UINT8, UINT8[3]	1
BT_10D	8	8	10	10	UINT8[2], UINT8[6]	1	UINT8[2], UINT8[6]	1
BT_22D	24	24	26	26	UINT8[2], UINT8[22]	1	UINT8[2], UINT8[22]	1
BT_46D	48	48	50	50	UINT8[2], UINT8[46]	1	UINT8[2], UINT8[46]	1

3.1.5.2.6.9 MP Bus Master Module

For the MP Bus Master Module, there is one module type:

Type of module	Description	Substitute I/O modules
MP_BUS	MP Bus Master Module	75x-643

For the MP Bus Master Module, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-643 MP-Bus							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
MP_Bus	8	8	10	10	UINT8[2], UINT8[6]	1	UINT8[2], UINT8[6]	1

3.1.5.2.6.10 Vibration Monitoring

For vibration monitoring, there is one module type:

Type of module	Description	Substitute I/O modules
VIB_IO	2-Channel, Vibration Velocity/ Bearing Condition Monitoring VIB I/O module	75x-645

With the 2-channel vibration velocity/bearing condition monitoring VIB I/O module, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-645 2-Channel Vibration Velocity/Bearing…							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
VIB_IO	12	12	14	14	UINT8, UINT16 UINT8, UINT8[2]	2	UINT8, UINT16 UINT8, UINT8[2]	2

3.1.5.2.6.11 Safety Modules PROFIsafe

For the Safety Module PROFIsafe, there is one module type:

Type of module	Description	Substitute I/O modules
PROFIsafe	Safety Module PROFIsafe	753-662/000-002, 753-667/000-002, 75x-661/000-003, 75x-662/000-003, 75x-666/000-003, 75x-667/000-003

The consumer status (IOPS) of the input or output information is exchanged between the IO controller and IO device in both directions with PROFIsafe I/O modules.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

<table>
<tr><th rowspan="4">Module
Type</th><th colspan="8">753-662/000-002 8F-DI
753-667/000-002 4F-DI/DO
75x-661/000-003 4F-DI
75x-662/000-003 8F-DI
75x-666/000-003 4FDI/2FDO
75x-667/000-003 4F-DI/DO</th></tr>
<tr><th colspan="4">Data length [Byte]</th><th colspan="4">Data object</th></tr>
<tr><th colspan="2">PI</th><th colspan="2">TLG</th><th rowspan="2">I</th><th rowspan="2">INST</th><th rowspan="2">O</th><th rowspan="2">INST</th></tr>
<tr><th>I</th><th>O</th><th>Tx</th><th>Rx</th></tr>
<tr><td>PROFIsafe</td><td>5</td><td>5</td><td>7</td><td>7</td><td>UINT8,
UINT8[4]</td><td>1</td><td>UINT8,
UINT8[4]</td><td>1</td></tr>
</table>

3.1.5.2.6.12 RTC Module

For the RTC module, there is one module type:

Type of module	Description	Substitute I/O modules
RTC	RTC Module	75x-640

For the RTC module, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-640 RTC							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
RTC	6	6	8	8	UINT8, UINT8[5]	1	UINT8, UINT8[5]	1

3.1.5.2.6.13 Stepper Controller

For the stepper controller, there is one module type:

Type of module	Description	Substitute I/O modules
STEPPER	Stepper Controller, Stepper Servo	75x-670, 75x-671, 750-672, 750-673,

For the stepper modules, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-670 / 75x-671 / 750-672 / 750-673							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
STEPPER	12	12	14	14	UINT8[2], UINT8[7], UINT8[3]	1	UINT8[2], UINT8[7], UINT8[3]	1

3.1.5.2.6.14 DC-Drive Controller

For the DC Drive controller, there is one module type:

Type of module	Description	Substitute I/O modules
DC_DRIVE	DC-Drive Controller	75x-636

With the DC-Drive controller, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.
The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	75x-636 DC Drive Controller							
	Data length [Byte]				Data object			
	PI		TLG		I	INST	O	INST
	I	O	Tx	Rx				
DC_DRIVE	6	6	8	8	UINT8, UINT8[5]	1	UINT8, UINT8[5]	1

3.1.5.2.7 System Modules

3.1.5.2.7.1 Power Supply Modules

The group of Power Supply modules is divided into 2 types of modules:

Type of module	Description	Substitute I/O modules
2DIA	Power Supply Module with 2 bit diagnostics	750-606, 750-610, 750-611
2DIA_PI	Power Supply Module with 2 bit diagnostics and additional diagnostics with input image	

In case there is no diagnostic data prepared in the input image, supply modules supply a provider status (IOPS) to the IO controller. If the input data is available in the input process image then the consumer status (IOCS) is received from the IO controller.

The following table shows a list of the number of bytes for the individual modules that are allocated in the respective process image (PA) and the telegrams (TLG) in the direction of transmission and reception (Tx, Rx).

Module / Type	750-6xx ...						750-6xx* ...					
	Data length / [Byte]				Data type		Data length / [Byte]				Data type	
	PI		TLG		I	O	PI		TLG		I	O
	I	O	Tx	Rx			I	O	Tx	Rx		
2DIA	0	0	1	1	-	-						
2DIA_PI	1	0	2	1	UINT8	-	0	0	1	1	-	-
	2	0	3	1	UINT16	-						
	4	0	5	1	UINT32	-						

3.1.5.3 Example

The allocation should become clear by way of a fieldbus node with a coupler and 17 I/O modules.

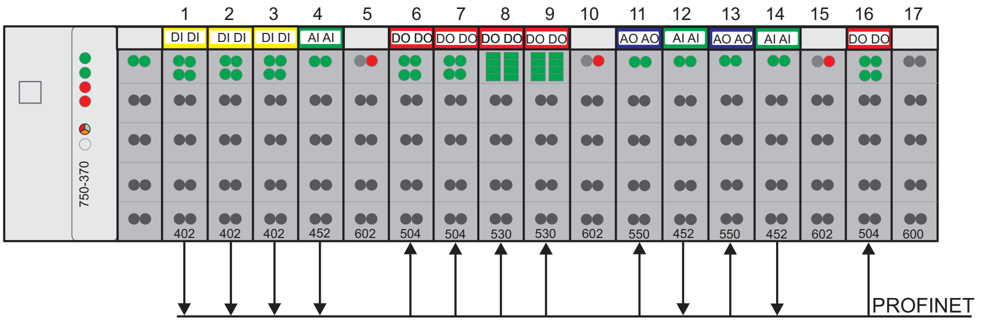


Fig. 3.1.5-8: Application example g037004x

No.	I/O module	Module	PA IO controller *	
		Identifier	Inputs	Outputs
1	Digital input	75x-402 4DI(+4 BIT I) (UINT8 IN)	E 12.0	---
	Digital input		E 12.1	---
	Digital input		E 12.2	---
	Digital input		E 12.3	---
2	Digital input	75x-402* 4DI(-4 BIT I) (-)	E 12.4	---
	Digital input		E 12.5	---
	Digital input		E 12.6	---
	Digital input		E 12.7	---
3	Digital input	75x-402 4DI(+12 BIT I) (UINT16 IN)	E 13.0	---
	Digital input		E 13.1	---
	Digital input		E 13.2	---
	Digital input		E 13.3	---
4	Analog input	750-452 2AI, 0-20 mA (INT16[2] IN)	EW 256	---
	Analog input		EW 258	---
5	Supply	750-610 Supply, DIA (-)	---	---
6	Digital output	75x-504 4DO(+28 BIT O) (UINT32 OUT)	---	A 8.0
	Digital output		---	A 8.1
	Digital output		---	A 8.2
	Digital output		---	A 8.3
7	Digital output	75x-504* 4DO(-4 BIT O) (-)	---	A 8.4
	Digital output		---	A 8.5
	Digital output		---	A 8.6
	Digital output		---	A 8.7

No.	I/O module	Module	PA IO controller *	
		Identifier	Inputs	Outputs
8	Digital output	75x-530* 8DO(-8 BIT O) (-)	---	A 9.0
	Digital output		---	A 9.1
	Digital output		---	A 9.2
	Digital output		---	A 9.3
	Digital output		---	A 9.4
	Digital output		---	A 9.5
	Digital output		---	A 9.6
	Digital output		---	A 9.7
9	Digital output	75x-530* 8DO(-8 BIT O) (-)	---	A 10.0
	Digital output		---	A 10.1
	Digital output		---	A 10.2
	Digital output		---	A 10.3
	Digital output		---	A 10.4
	Digital output		---	A 10.5
	Digital output		---	A 10.6
	Digital output		---	A 10.7
10	Power supply	750-610 P-Supply, DIA (-)	---	---
11	Analog output	750-550 2AO, 0-10 V (INT16[2] OUT)	---	AW 256
	Analog output		---	AW 258
12	Analog input	750-452 2AI, 0-20 mA (INT16[2] IN)	EW 260	---
	Analog input		EW 262	---
13	Analog output	750-550 2AO, 0-10 V, EM ({UINT8, INT16}[2] IN/OUT)	EB264, EW265	AB264, AW265
	Analog output		EB267, EW268	AB267, AW268
14	Analog input	750-452 2AI, 0-20 mA, EM {UINT8, INT16}[2] IN/OUT	EB270, EW271	AB270, AW271
	Analog input		EB273, EW274	AB273, AW274
15	Power supply	750-610 P-Supply. 2DIA(+6 BIT I), DIA in I-PI (UINT8 IN)	E 14.0 ... E 14.1	---
16	Digital output	75x-504 4DO(+4 BIT O) (UINT8 OUT)	---	A 11.0
	Digital output		---	A 11.1
	Digital output		---	A 11.2
	Digital output		---	A 11.3
17	End module	End module	---	---

* The addresses stated in the table correspond with the process data allocation given in the hardware configuration.

3.1.5.4 Establishing the Connection

Before starting the productive data exchange between the IO controller and the IO device, individual communication instances are created within the PROFINET IO context management and the I/O configuration (expected configuration) of the modules is notified. After the connection structure has been checked and once the actual configuration has been adjusted (optional), the IO device receives all necessary operating settings (parameters) so that the cyclic data exchange via "record data" sets can be established. Both the buscoupler and the connected I/O modules are supplied with parameters. Once all settings have been made, the IO device signals that it is ready to send and receive cyclic productive data.

3.1.6 Configuration and Parameter Setting of I/O Modules

Setting the parameters of I/O modules is performed via "record data" sets. Modules with diagnostic capability allow the diagnostic message to be disabled or enabled for each channel. Digital outputs provide the possibility of switching a configurable substitute value for each channel in the case of invalid output information.

Possible configuration and parameter values can be found in chapter 5.3, „Configuration and Parameter Settings of the ".

Note
For simplification, only the item numbers are shown as module designation in the table. Therefore, the module "75x-400" corresponds to module "750-400 2 DI/24 V DC/3.0 ms" or "753-400 2 DI/24 V DC/3.0ms".

3.1.7 iParameter Server

With the approach of the iParameter server, the PROFIBUS & PROFINET user organization offers the opportunity to store complex parameter structures of I/O modules on the superior controller during start-up, and if necessary, generally after the replacement of a component, to make it available again.

3.1.7.1 Function

The individual parameters, or iParameters for short, are used to parameterize the device functions of an I/O module. Based on current definitions, a manufacturer tool such as the WAGO parameterization tool must be used.

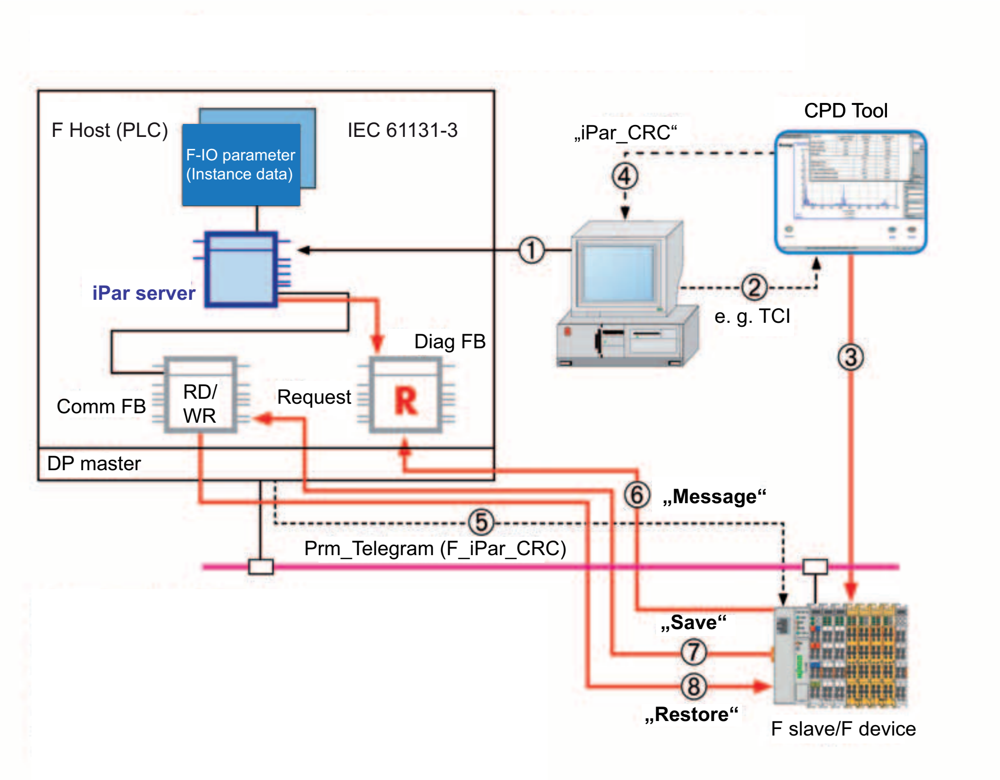


Fig. 3.1.7-9: Principle of the iParameter server g075x0667

Steps for the use of the iParameter server	
No.	**Meaning**
1	Instantiation of the "iPar Server" function.
2	CDP Tool Start and parameter transfer (e.g., node address)
3	iParameterization and start-up, test and release
4	Transfer of iParamter backup (signature) to the host
5	Transmission of the signature to the I/O module (parameterization phase) on start-up
6	Message to iPar server about diagnostic agent (alarm/status)
7	iPar server polls Diag FB and starts "Save" if required
8	iPar server polls Diag FB and starts "Restore" if required

Tab. 3-1: Steps for the use of the iParameter server

It is often required during a repair to quickly replace a device without using additional manufacturer tools for parameterization of the device functions. To fulfill this requirement, the iParameter server is used; it offers appropriate services for saving and restoring iParameters. The iParameter server is made available as a function module or a system function of the PLC.

3.1.7.2 I/O Modules with iParameter Client

I/O Module with iParameter Client		
Item Number	**Name**	**GSD entry**
75x-661/000-003	4FDI 24V DC PROFIsafe V2 iPar	75x-661 4FDI iPar-Server
75x-662/000-003	8FDI 24V DC PROFIsafe V2 iPar	75x-662 8FDI iPar-Server
75x-666/000-003	4FDI/1FDO 24V/10A PROFIsafe V2 iPar	75x-666 4FDI/2FDO iPar-Server
75x-667/000-003	4FDI / 4FDO 2A / 24V DC PROFIsafe V2 iPar	75x-667 4FDI/4FDO iPar-Server

Tab. 3-2: I/O modules with iParameter client functionality

3.1.8 Diagnostics

3.1.8.1 Diagnostic Data Sets

The diagnostic information of the buscoupler (IO device) can be read out acyclically using standard diagnostic data sets (records). The structure of the data sets is defined in the PROFINET IO specification (see IODReadReq or IODReadRes). The data set number (index) allows distinguishing between the diagnostic level and the diagnostic structures.

The following diagnostic data sets can be requested in case of an upcoming diagnostic message:

Data set number		Description	Available on slot
0x800A	32778	Standardized channel diagnostics of a sub-module slot (sub-slot specific)	0 ... 128
0x800B	32779		
0x800C	32780		
0xAFF0	45040	Data sets for identification and servicing purposes	0
0xC00A	49162	Channel diagnostics of a slot (slot specific); currently identical with the data set number 800AH, as only one sub-module can exist for each module.	0 ... 128
0xC00B	49163		
0xC00C	49164		
0xE002	57346	Deviations in the set and actual configuration of the sub-modules allocated to the IO controller (IOC-AR).	0
0xE00A	57354	Channel diagnostics of all signal channels allocated to a connection (AR), contains all channel diagnostic structures of the sub-module slots.	0
0xE00B	57355		
0xE00C	57356		
0xF00A	61450	Channel diagnostics of all signal channels allocated to the application profile 0 (API 0)[*1)], contains all channel diagnostic structures of the individual sub-module slots.[*1)]	0
0xF00B	61451		
0xF00C	61452		

[*1)] Several connections (AR´s) can be established to an API. The buscoupler only enables one connection (AR) of the API 0 to an IO controller in the firmware versions 01 and 02.

3.1.8.2 Structure of the Standardized Diagnostic Data Sets

The diagnostic data sets comprise of several structure elements. The first element in the data set is the head of the structure. It describes the version and the length of the following data. An identifier `(BlockType)`specifies the structure of the diagnostic data. The following identifiers are currently used by the buscoupler:

Identifier	Description
0x0010	Channel Diagnostics
0x8104	Deviating expected / actual configuration

The version enables you to see if the process type (**A**pplication **P**rocess **I**dentifier – API) follows immediately after the head structure or not.

Version	Description
1.0	Data set does not contain the API
1.1	Data set contains the API

The head of the structure has a length of 6 bytes and is composed of as follows:

Byte offset	Data type			Description	
0 / 1	WORD			**Database contents**	
				0x0010	Channel Diagnostics
				0x8104	Deviating set / actual configuration
2 / 3	WORD			**Length of the data sets in bytes**	
					Length of the version in bytes including
4/5	BYTE	0x01		**Version (major) = 1**	
	BYTE			**Version (minor)**	
				0	Diagnostic data will follow at the end
				1	API will follow at the end
6 / 7	DWORD	0x00	0x00	**API = 0**	
8 / 9		0x00	0x00		Only available in version 1,1

The process type API has a data length of 4 bytes. Depending on the version of the data set, the diagnostic data follow with byte offset 6 (version 1.0) or byte offset 10 (version 1.1). However, the description of the diagnostic data in the sub-chapters - depending on the `BlockType` - begins back with byteoffset 0.

3.1.8.2.1 Channel Specific Diagnostics

Errors occurring when configuring and setting the parameters of the station (IO device) and the connected I/O modules as well as external errors from the connected periphery are reported by the buscoupler via channel specific diagnostics. External errors reported by the subassemblies (e.g. short circuits, line interruptions) are only transmitted to the IO controller after enabling when setting the module's parameters.

The BlockType in the head structure of the data set corresponds to the value for the channel diagnostics (0x0010). The length defines the following diagnostic data for faulty sub-modules or channels.

The data for the channel diagnostics is triggered using a general structure (see ChannelDiagnosis or ExtChannelDiagnosis), which is followed by the fault indication of the respective channels. The general structure has a length of 10 bytes and is composed of as follows:

Byte-offset	Data type			Description	
0 / 1	WORD			**Module slot for the alarm source**	
				Range	0 ... 128
2 / 3	WORD	0x00	0x01	**Sub-module slot for the alarm source = 1**	
4 / 5	WORD	0x80	0x00	**ID of the alarm source = sub module (0x8000)**	
6 / 7	BYTE	0x08		**Fault type = upcoming fault (0x08)**	
	BYTE		0x00	**Reserved (0x00)**	
8 / 9	WORD			**Fault type = diagnostics for the sub module**	
				0x8000	Channel Diagnostics
				0x8002	Extended channel diagnostics

As already mentioned, special data sets of faulty sub-modules or channels are following the general structure. This information may be repeated depending on how many different fault messages exist for the channels of a sub-module. The number of existing channel diagnostic data sets can be determined using the length indicated in the head structure.

The following sub-chapters describe the standardized and extended channel diagnostic information that is supported by the coupler.

3.1.8.2.1.1 Channel Diagnostics

The channel diagnostics is set by the coupler when external channel faults occur (e.g. short circuits or overvoltage). These types of faults are defined in the PROFINET IO specification.

The fault type (SubStructureDefined) contains the value for channel diagnostics (0x8000).

Each fault of a signal channel or sub-module is described in a data set (see ChannelDiagnosisData). The structure of the data set has 6 bytes and is composed of as follows:

Byte offset	Data type			Description		
0 / 1	WORD			**Alarm source**		
				0x0000 ... 0x0007 0x8000	Channel 0 … 7 Sub-module	
2 / 3	BYTE			**Fault- / Channel type**		
				2^2 ... 2^0	reserved	
				2^4, 2^3	Fault type = upcoming fault = 1	
				2^7 ... 2^5	Channel type	
					'000'	reserved
					'001'	Input channel
					'010'	Output channel
					'011'	Input / Output channel
					'100' ... '111'	reserved
	BYTE			**Data format**		
				0x00	User defined data format	
				0x01	Bit	
				0x02	2 Bit	
				0x03	4 Bit	
				0x04	Byte	
				0x05	Word	
				0x06	Double word	
				0x07	2 double words	
				0x08 ... 0xFF	reserved	
4 / 5	WORD			**Fault type**		
				0x0000	Reserved, not specified	
				0x0001	Short circuit	
				0x0002	Low voltage	
				0x0003	High voltage	
				0x0004	Overload	
				0x0005	Over temperature	
				0x0006	Wire Break	
				0x0007	Upper limit value exceeded	
				0x0008	Lower limit value exceeded	
				0x0009	Fault	
				0x000A ... 0x000F	Reserved	
				0x0010	Faulty parameter setting	
				0x0011	Faulty voltage supply	
				0x0012	Fuse fault	
				0x0013	Receiver buffer overflow	
				0x0014	Ground fault	
				0x0015	Reference point is no longer available	
				0x0016	Sampling fault	
				0x0017	Threshold value undershot / overshot	
				0x0018	Output deactivated	
				0x0019	Safety relevant fault	
				0x001A	External fault	
				0x001B	Frame fault	
				0x001C	Cycle time fault	
				0x001D ... 0x001E	Manufacturer specific	
				0x001F	Module fault	

Byte offset	Data type			Description	
				0x0020 ... 0x003F	Reserved
				0x0040 … 0x00FF	Reserved
				0x0100 ... 0x7FFF	Manufacturer specific
				0x8000 ... 0xFFFF	Reserved

3.1.8.2.1.2 Error Types of I/O Modules with Diagnostic Capability

The error numbers 0x0000 / 0 to 0x000F / 15 contain standard messages. The allocated meaning of error numbers 0x001B / 27 to 0x001F / 31 are recommended in the specification. Starting with error number 0x0020 / 32, the associated error messages are reserved or can be used according to the manufacturer specifications.

Error Number		Significance
STANDARDIZED	0x0000 / 0	Reserved, not specified
	0x0001 / 1	Short circuit
	0x0002 / 2	Undervoltage
	0x0003 / 3	Overvoltage
	0x0004 / 4	Overload
	0x0005 / 5	Overtemperature
	0x0006 / 6	Wire Break
	0x0007 / 7	Upper limit value exceeded
	0x0008 / 8	Lower limit value undershot
	0x0009 / 9	Fault
	0x000A / 10 ... 0x000F / 15	reserved
QUASISTANDARDIZED	0x0010 / 16	Configuration fault
	0x0011 / 17	Transmitter or load voltage missing
	0x0012 / 18	Fuse fault
	0x0013 / 19	free
	0x0014 / 20	Ground fault
	0x0015 / 21	Reference channel fault
	0x0016 / 22	Sampling fault
	0x0017 / 23	Threshold value undershot / overshot
	0x0018 / 24	Output deactivated
	0x0019 / 25	Safety relevant fault
	0x001A / 26	External fault
	0x001B / 27	Free
	0x001C / 28	Error PROFIsafe I/O module

Error Number		Significance
	0x001D / 29 ... 0x001E / 30	free
	0x001F / 31	Missing configuration
RESERVED	0x0020 / 32 ... 0x003F / 64	Reserved
RESERVED	0x0040 / 64 ... 0x00FF / 255	Reserved
	0x0100 / 256	Internal bus fault
RESERVED	0x0101 / 257 ... 0x7FFF / 32767	Manufacturer specific
	0x8000 / 32768 ... 0xFFFF / 65535	Reserved

3.1.8.2.2 Error Types of I/O Modules with Diagnostic Capability

Item number	Data format	Error type		Significance
75x-418, 75x-419, 75x-421	BIT	0x001A / 26	External fault	Short circuit of the transmitter power supply
75x-425	BIT	0x001A / 26	External fault	Signal line to transmitter interrupted or short circuited
75x-506	BIT	0x0001 / 1 0x0002 / 2 0x0006 / 6	Short circuit Overvoltage Line break	Signal output short circuited Field voltage to the signal output inadequate Signal line to the actuator interrupted or not connected
75x-507, 75x-532, 75x-537	BIT	0x001A / 26	External fault	Short circuit of the signal output against +24 V or GND, signal line to the actuator is interrupted or not connected or excess temperature through overloading.
75x-522, 750-523	BIT	0x001A / 26	External fault	External fault (broken wire, overload or short circuit, manual operation)
75x-460, 75x-461, 75x-481, 75x-469, 750-487	WORD	0x0006 / 6 0x0008 / 8 0x0009 / 9	Broken wire Lower limit value undershot Fault	Signal line to transmitter interrupted Measurement range shortfall or signal line to the transmitter has a short circuit Internal fault (e.g. hardware)
75x-464	WORD	0x0001 / 1 0x0006 / 6 0x0007 / 7 0x0008 / 8 0x0009 / 9	Short circuit Line break Upper limit value exceeded Lower limit value undershot Fault	Signal line to transmitter short-circuited Signal line to transmitter interrupted Upper measurement range end value exceeded Lower measurement range end value undershot Internal fault (e.g. hardware fault)
75x-452, 75x-465, 75x-467, 75x-468, 75x-470, 75x-472, 75x-475, 75x-477	WORD	0x0007 / 7 0x0009 / 9	Upper limit value exceeded Fault	Measurement range overflow Internal fault (e.g. hardware fault)

Item number	Data format	Error type		Significance
75x-453, 75x-454, 75x-455, 75x-456, 75x-457, 75x-459, 75x-466, 75x-474, 75x-476, 75x-478, 75x-479, 75x-480, 75x-483, 75x-485, 75x-492	WORD	0x0007 / 7 0x0008 / 8 0x0009 / 9	Upper limit value exceeded Lower limit value undershot Fault	Measurement range overflow of the input signal Measurement range shortfall of the input signal Internal fault (e.g. hardware fault)
75x-491	WORD	0x0003 / 3 0x0007 / 7 0x0009 / 9	Overvoltage Upper limit value exceeded Fault	 Measurement range overflow of the input signal Internal fault (e.g. hardware fault)
75x-493	WORD	0x0002 / 2	Low voltage	
75x-553, 75x-555, 75x-557, 75x-559, 75x-560, 75x-562, 75x-563	WORD	0x0009 / 9	Fault	Output short circuit Internal fault (e.g. hardware fault)
750-606	BIT	0x0002 / 2 0x0011 / 17 0x001A / 26	Low voltage Transmitter or load voltage lacking External fault	Output voltage too low Field voltage not present or too low Output voltage short-circuited
750-610, 750-611	BIT	0x0011 / 17 0x0012 / 18	Transmitter or load voltage missing Fuse defective	Field voltage too low or not present Fuse defective or not present
75x-630	DWORD	0x0016 / 22 0x001A / 26	Sampling fault External fault	An incorrect data frame exists, i.e. the data frame is not terminated with zero (possible wire break of clock lines). SSI has no power supply or data line break, or D+ and D- have been inverted.

Item number	Data format	Error type		Significance
75x-635	OTHER	0x0009 / 9	Fault	Wave speed has not been set or inadequate stop impulse or the maximum wave speed has been exceeded or timeout, no measurement values exist, measurement value is invalid or fault when setting the wave speed or zero point has occurred or invalid transmitter selection, the selected transmitter address is invalid because of the missing initialization
75x-636	OTHER	0x0009 / 9	Fault	A status/fault message is present.
75x-637	OTHER	0x0009 / 9	Fault	Loss of the field supply
75x-641	OTHER	0x0009 / 9 0x001A / 26	Fault External fault	General module faults such as POST of the internal flash memory, DALI bus faults (continuous short circuit or open circuit), however, no faulty electronic ballasts.
75x-642, 75x-650, 75x-651, 75x-652, 75x-653	OTHER	0x0007 / 7	Upper limit value exceeded	The receiver buffer is completely full, there is a danger of loss of data
75x-643	OTHER	0x0009 / 9	Fault	Internal fault (e.g. hardware fault)
75x-644	OTHER	0x0009 / 9	Fault	Non-existent or invalid process data
75x-655	OTHER	0x0002 / 2 0x0009 / 9 0x001D / 29	Low voltage Fault Bus communication flawed	Field supply and/or ASi supply flawed Field supply and/or ASi supply flawed and ASi interface inactive ASi interface intactive
75x-670 75x-671 75x-672 75x-673	OTHER	0x0009 / 9	Fault	Fault present

Item number	Data format	Error type		Significance
753-662/ 000-002, 753-667/ 000-002 75x-661/ 000-003 75x-662/ 000-003 75x-666/ 000-003 75x-667/ 000-003	OTHER	0x0040 / 64	F_Dest_Add mismatch	The PROFIsafe address set within the scope of F-Parameterization differs to the one adjusted on F-I/O module. Please check the DIP switch setting, respectively the PROFIsafe address stored by safety editor (SEDI).
		0x0041 / 65	Invalid F_Dest_Add	The PROFIsafe address of the F-I/O module must be in the range of 1 ... 65534. Please adjust the F-Parameterization.
		0x0042 / 66	Invalid F_Source_Add	The PROFIsafe address of the F-Host must be in the range of 1 ... 65534. Please adjust the F-Parameterization.
		0x0043 / 67	Invalid F_WD_Time	The monitoring time for the failsafe data exchange must be adjusted to values greater than 0 ms. Please adjust the F-Parameterization.
		0x0044 / 68	Unsupported F_SIL	The F I/O module cannot operate in the adjusted SIL. Please adjust the F-Parameterization to the right SIL.
		0x0045 / 69	Wrong F_CRC_Length	The selected F_CRC_Length to secure failsafe process data to be exchanged is impossible in current operating mode. Please consider the dependency between F_Par_Version and F_CRC_Length and choose a valid combination within F-Parameter set.
		0x0046 / 70	Wrong F_Par_Version	The selected F_Par_Version is impossible in current operating mode. Please consider the dependency between F_Par_Version and F_CRC_Length and choose a valid combination within F-Parameter set.
		0x0047 / 71	Invalid F_CRC1	The calculated F_CRC1 of F-Parameter set is invalid. Please create a consistent F Parameter set.
75x-661/ 000-003 75x-662/ 000-003 75x-666/ 000-003 75x-667/ 000-003		0x0049 / 73	Faulty iParameter upload	Timeout while requesting iPar-Server to save (upload) F-I/O modules iParameter set. Please check if an iPar-Server instance has been assigned to F-I/O module within application program.
		0x004A / 74	Faulty iParameter download	Timeout while requesting iPar-Server to save (upload) F-I/O modules iParameter set. Please check if an iPar-Server instance has been assigned to F-I/O module within application program and ensure a respective iParameter database to be available.
		0x004B / 75	Invalid iParam. from iPar server	The individual parameter set provided from iPar-Server is inconsistent. Please ensure a consistent individual parameter set to be available on iPar-Server. Please check the fieldbus transmission where required.

Item number	Data format	Error type		Significance
		0x004C / 76	Unsupported F_Block_ID	The F I/O module does not support an F-Parameterization block being advised by current F-Block_ID. Please use a supported F-Parameterization block.
		0x0200 / 512	F-Module has invalid iParameters	The individual parameter set of the F-I/O module is inconsistent. Please adjust the parameter set with regard to dependencies between several settings.
		0x0201 / 513	Short circuit	The input of the F-I/O module is not supplied by its related clock output or is short-circuited to +24 V field supply. Please check the wiring of the input.
		0x0202 / 514	Undervoltage	The 24 V field power supply of the F-I/O module falls below the specified tolerance. Please adjust the power supply.
		0x0203 / 515	Overvoltage PWR	The 24 V field power supply of the F-I/O module exceeds the specified tolerance. Please adjust the power supply.
	BIT	0x0204 / 516	Overload	The maximum output load of the F-I/O module has been exceeded or the connections + and - are short-circuited. Please check the load and the wiring of the output.
	OTHER	0x0205 / 517	Overtemperature	The permissible operating temperature of electronic devices inside the F-I/O module has been exceeded. Please ensure the ambient temperature to be within specified range.
	BIT	0x0206 / 518	Line break	The output of the F-I/O module is not connected to its load. Please check the wiring of the output.
	OTHER	0x0209 / 521	Internal error	The internal hardware test of the F-I/O modules failed or its operating program does not work properly. Please substitute the F-I/O module immediately and send it to WAGO for fault isolation.
		0x020B / 523	Short circuit on T1	The clock output T1 of the F-I/O module is short-circuited to 0 V potential of field power supply. Please check the wiring of the clock output.
		0x020C / 524	Short circuit on T2	The clock output T2 of the F-I/O module is short-circuited to 0 V potential of field power supply. Please check the wiring of the clock output.
		0x0219 / 537	Safety shutdown	The F-I/O module entered the failsafe state and shut down the outputs. Please replace the F-I/O module immediately and send it to WAGO for fault isolation.

Item number	Data format	Error type		Significance
	BIT	0x021B / 539	Short circuit to VCC	The + terminal of the F-I/O module is short-circuited to +24 V potential of field power supply. Please check the wiring of the output. The output is possibly defective.
	BIT	0x021C / 540	Short circuit to GND	The - terminal of the F-I/O module is short-circuited to 0 V potential of field power supply. Please check the wiring of the output. The output is possibly defective.
	OTHER	0x021D / 541	Wiring error	The wiring of output O2 is incompatible to the adjusted output configuration. Please reconfigure the output settings or adjust the wiring.
	BIT	0x021E / 542	Discrepancy time exceeded	The F-I/O module has detected a violation of adjusted discrepancy time in 2-out-of-2 evaluation mode of the input pair. Please check the connected gates. Adjust the discrepancy time setting where required.
	OTHER	0x0220 / 544	Undervoltage PWR	The 24 V system power supply of the F-I/O module falls below the specified tolerance. Please check the concerned power supply. Please also check if the fuse has blown due to a short circuit.
	OTHER	0x1000 / 4096	Sequence error iParameterization	The iPar-Server has tried to access the iParmeters without any notification from the I/O module. Please ensure iPar-Server to be working properly.
753-662/ 000-002, 753-667/ 000-002	BIT	0x0001 / 1	Short circuit	The input of the F-I/O module is not supplied by its related clock output or is short-circuited to +24 V field supply. Please check the wiring of the input.
	OTHER	0x0002 / 2	Undervoltage	The 24 V field power supply of the F-IO module falls below the specified tolerance. Please adjust the power supply.
	BIT	0x0004 / 4	Overload	The maximum output load of the F-I/O module has been exceeded or the connections + and - are short-circuited. Please check the load and the wiring of the output.
	OTHER	0x0005 / 5	Overtemperature	The permissible operating temperature of electronic devices inside the F-I/O module has been exceeded. Please ensure the ambient temperature to be within specified range.
	BIT	0x0006 / 6	Line break	The output of the F-I/O module is not connected to its load. Please check the wiring of the output.
	BIT	0x0009 / 9	Fault	The input of the F-I/O module is not supplied by the associated clock output or is connected to a +24 V field supply directly. Check the input wiring.

Item number	Data format	Error type		Significance
	OTHER	0x0019 / 25	Safety shutdown	The F-I/O module entered the failsafe state and shut down the outputs. Please replace the F-I/O module immediately and send it to WAGO for fault isolation.
	OTHER	0x0020 / 32	External fault	
	BIT	0x0023 / 35	Short circuit to VCC	The + terminal of the F-I/O modules is short-circuited to +24 V potential of field power supply. Please check the wiring of the output. The output is possibly defective.
	BIT	0x0024 / 36	Short circuit to GND	The - terminal of the F-I/O module is short-circuited to 0 V potential of field power supply. Please check the wiring of the output. The output is possibly defective.
	BIT	0x0027 / 39	Discrepancy time exceeded	The F-I/O module has detected a violation of adjusted discrepancy time in 2-out-of-2 evaluation mode of the input pair. Please check the connected gates. Adjust the discrepancy time setting where required.
	OTHER	0x0041 / 65	Missing or incorrect iParameter	The individual parameter set for the F-I/O module is inconsistent. Transmit a valid iParameter set to the F-module using SEDI.

3.1.8.2.2.1 Extended Channel Diagnostics

The buscoupler uses the extended channel diagnostics to signal internal bus, configuration and parameter setting faults. According to the PROFINET IO standard, extended fault information must be expressed according to the manufacturer specifications.

The fault type (`UserstructureIdentifier`) has the value for the extended channel diagnostics (0x8002).

The structure for the data set (see `ExtChannelDiagnosisData`) has 12 bytes and is composed of as follows:

Byte offset	Data type			Description		
0 / 1	WORD			**Alarm source**		
				0x0000 ... 0x0007 0x8000	Channel 0 … 7 Sub-module	
2 / 3	BYTE			**Fault- / Channel type**		
				2^2 ... 2^0	reserved	
				2^4, 2^3	Fault type = upcoming fault = 1	
				2^7 ... 2^5	Channel type	
					'000'	reserved
					'001'	Input channel
					'010'	Output channel
					'011'	Input / Output channel
					'100' ... '111'	reserved
	BYTE			**Data format**		
				0x00	User defined data format	
				0x01	Bit	
				0x02	2 Bit	
				0x03	4 Bit	
				0x04	Byte	
				0x05	Word	
				0x06	Double word	
				0x07	2 double words	
				0x08 ... 0xFF	reserved	
4 / 5	WORD			**Fault type**		
				0x0000	reserved, not spesified	
				0x0010	Faulty parameter setting	
				0x001F	Missing configuration	
				0x0100	Internal data bus fault	
6 / 7	WORD			**Extended fault type**		
				0x0000 ... 0xFFFF	Extended fault description	
8 / 9	DWORD			**Additional value**		
10 / 11					Additional fault description	

The following tables describe the possible fault messages that are based on the combination of fault type, extended fault type and additional value. The “xx” symbols used for some additional values represent the signal channel (0x0000 ... 0x0007) where the fault has been detected.

The faults described in the following table are faults occurring when configuring both the station substitute (buscoupler) and the modules (I/O modules). Configuration faults are coded using fault type **0x0010** in accordance with the PROFINET IO standard.

Fault type “Configuration fault” (0x0010)“		
Extended fault type	**Additional value**	**Description**
0x0001	0xC0018001	The module type (Identifier) is not recognized.
0x0002	0xC0018002	The module type (Identifier) is invalid.
0x0003	0xC0018003	The status of the module is not allowed during configuration.
0x0004	0xC0018004	The length of the configuration data for the module is smaller than expected.
0x0005	0xC0018005	The length of the configuration data for the module is larger than expected.
0x0006	0xC0018006	The received configuration data for the module is not supported.
0x0007	0xC0018007	The characteristics (Property) for the module are not supported.
0x0008	0xC0018008	The reserved module parameter have an invalid value.
0x000A	0xC001800A	Parameters are not permissible.
0x000B	0xC001800B	Index of dataset is not allowed.
0x000C	0xC001800C	Fault when accessing module registers
0x000D	0xC001800D	Data length is invalid when accessing module registers.
0x0010	0xC0018010	The substitute value behavior for the inputs of the module is not supported.
0x0011	0xC0018011	The substitute value behavior for the inputs of the module is not allowed.
0x0014	0xC0018014	The reserved input parameters of the module have an invalid value.
0x0020	0xC0018020	The substitute value behavior for the outputs of the module are not supported
0x0021	0xC0018021	The substitute value behavior for the output of the module is not allowed.
0x0024	0xC0018024	The reserved output parameters of the module have an invalid value.
0x0030	0xC0018030	The combination of input and diagnostics is not supported in the process image.
0x0031	0xC0018031	The combination of input and diagnostics is not allowed in the process image.

Fault type “Configuration fault” (0x0010)“		
Extended fault type	**Additional value**	**Description**
0x0032	0xC0018032	The bit offset for the output of the module is not allowed.
0x0033	0xC0018033	The bit offset for the diagnostic of the module exceeds the maximum offset.
0x0034	0xC0018034	The reserved diagnostic parameters of the module have an invalid value.
0x0035	0xC0018035	The diagnostic connection of the module is aborted.
0x0051	0xC001xx51	The reserved channel parameter of the module has an invalid value.
0x0060	0xC001xx60	The substitute value for the input channel of the module is not allowed.
0x0061	0xC001xx61	The substitute value for the input channel of the module exceeds its maximum.
0x0062	0xC001xx62	The substitute value for the input channel of the module falls below its minimum.
0x0070	0xC001xx70	The substitute value for the output channel of the module is not allowed.
0x0071	0xC001xx71	The substitute value for the output channel of the module exceeds its maximum.
0x0072	0xC001xx72	The substitute value for the output channel of the module falls below its minimum.
0x0080	0xC001xx80	The substitute value for the output channel of the module is not allowed.
0x0081	0xC001xx81	The connection of the channel diagnostics of the module is not allowed.
0x0090	0xC0018090	The status of the station during the configuration is not allowed.
0x0091	0xC0018091	The length of the configuration data for the station is smaller than expected.
0x0092	0xC0018092	The length of the configuration data for the station is larger than expected.
0x0093	0xC0018093	The reserved station parameters (Table 0, register 0) have invalid values.
0x0094	0xC0018094	The reserved station parameters (Table 0, register 1) have invalid values.
0x0095	0xC0018095	The register access (Table 0, register 1) is not allowed.
0x0096	0xC0018096	The setting of the diagnostic channel (Table 0, register 1) is not allowed.
0x0097	0xC0018097	The reserved station parameters (Table 0, register 2) have invalid values.
0x0098	0xC0018098	The setting for the internal data bus extension (Table 0, register 2) is not allowed.

Fault type “Configuration fault” (0x0010)“		
Extended fault type	**Additional value**	**Description**
0x0099	0xC0018099	The reserved station parameters (Table 0, register 3) have invalid values.
0x009A	0xC001809A	The connection for creating the process image (Table 0, register 3) is deactivated.
0x009B	0xC001809B	The algorithm for creating the process image (Table 0, register 3) is not allowed.
0x009C	0xC001809C	The integration of control and status data of complex modules (Table 0, register 3) is activated.
0x009D	0xC001809D	Formatting of complex module data (Table 0, register 3) is not allowed.
0x009E	0xC001809E	Formatting of digital module data (Table 0, register 3) is not allowed.
0x009F	0xC001809F	The data allocation (Table 0, register 3) is not allowed (neither bytes nor words).
0x00A0	0xC00180A0	The setting for updating the input data (Table 0, register 3) is not allowed (not asynchronous).
0x00A1	0xC00180A1	The setting for updating the output data (Table 0, register 3) is not allowed (not asynchronous).
0x00A2	0xC00180A2	The setting for the behavior of fieldbus faults (Table 0, register 3) is not allowed.
0x00A3	0xC00180A3	The setting for the behavior of internal data bus faults (Table 0, register 3) is not allowed.
0x00A4	0xC00180A4	The setting for activating the diagnostics (Table 0, register 3) is not allowed.
0x00A5	0xC00180A5	The linking of the diagnostic data to the process image (Table 0, register 3) is activated.
0x00A6	0xC00180A6	The reserved station parameters (Table 0, register 4) have invalid values.
...	...	...
0x00B2	0xC00180B2	The reserved station parameters (Table 0, register 4) have invalid values.
0x00B3	0xC00180B3	The reserved station parameter (Table 100, register 75) have invalid values.
0x00B4	0xC00180B4	The module setting (Table 100, register 75) is not allowed.
0x00B5	0xC00180B5	The reserved station parameter (Table 100, register 76) have invalid values.
0x00B6	0xC00180B6	The reserved station parameter (Table 100, register 77) have invalid values.
0x00B7	0xC00180B9	The setting for the behavior of PROFINET IO faults (stop internal data bus) when using PROFIsafe modules is not allowed.

Missing parameters for both the station substitute (buscoupler) and the modules (I/O modules) are also reported using an extended channel diagnostics. Fault type **0x001F** is classified as missing parameters in accordance with the standard.

Fault type "missing parameters (0x001F)"		
Extended fault type	**Additional value**	**Description**
0x0009	0xC0018009	Module or coupler is not configured.

Faults occurring on the internal data bus system are also indicated by transmitting an extended channel diagnostics. This is a manufacturer specific fault that is displayed using the fault type **100_H**. Additional fault information is available in the following table.

Fault type "Internal bus fault (0x0100)"		
Extended fault type	**Additional value**	**Description**
0x0001	0x00000106	The module configuration that has been determined on the internal bus after AUTORESET differs from the configuration performed before the internal bus fault occurred.
0x0003	0x01100300	Internal bus protocol fault due to internal bus RESET fault.
0x0003	0x01110300	Internal bus protocol fault due to command fault.
0x0003	0x01120300	Internal bus protocol fault due to faulty input data.
0x0003	0x01140300	Internal bus protocol fault due to faulty output data.
0x0003	0x01180300	Internal bus protocol fault caused by timeout.
0x0004	0x011204xx	Internal bus interruption after module slot xx (xx = 0 ... 128).
0x0005	0x011005xx	Internal bus initializing fault because of an abortive register communication with the module on slot xx (xx = 1 ... 128).

Invalid module configurations are reported via manufacturer specific fault of type **101_H**. Additional fault information is available in the following table.

Fault type "Configuration fault (0x0101)"		
Extended fault type	**Additional value**	**Description**
0x0012	0xC0018012	The bit offset for the inputs of the module is not allowed.
0x0013	0xC0018013	The bit offset for the inputs of the module exceed the maximum offset.
0x0015	0xC0018015	The configured data length for the input module is smaller than expected.
0x0016	0xC0018016	The configured data length for the input module is larger than expected.
0x0017	0xC0018017	The configured data length for the input module is not allowed.
0x0022	0xC0018022	The bit offset for the output of the module is not allowed.
0x0023	0xC0018023	The bit offset for the output of the module exceeds the maximum offset.
0x0025	0xC0018025	The configured data length for the output module is smaller than expected.
0x0026	0xC0018026	The configured data length for the output module is larger than expected.
0x0027	0xC0018027	The configured data length for the output module is not allowed.

If a fault occurs on the internal data bus system when the PNIO connection is being established and if auto reset of the internal data bus was set by the station proxy, then the PNIO connection must be interrupted and re-established in order to set the parameters of the connected I/O modules. The reconfiguration request is triggered by a manufacturer specific fault of type **102_H**. Additional fault information is available in the following table.

Fault type "Reconfiguration required (0x0102)"		
Extended fault type	**Additional value**	**Description**
0x00B9	0xC00180B9	Configuration is requested due to an internal data bus fault. This can be performed via interruption and re-establishment of the PNIO connection.

3.1.8.2.3 Difference between Expected and Actual Configuration

A diagnostics is performed by the coupler when there is a difference between the module configuration of the IO controller and the number of connected sub-modules (I/O modules).

The `BlockType` in the head structure of the data set corresponds to the value of the module differences (0x8104). The length gives information on the differences between the configured and connected modules or sub-modules.

A structure head is used for the module differences.

Byte offset	Data type			Description	
0 / 1	DWORD	0x00	0x00	**API** (**A**pplication **P**rocess **I**nstance) = 0	
2 / 3		0x00	0x00		
4 / 5	WORD			**Number of slots with differences between target and actual configuration**	
					dependent on the number of data sets that follow

The number of data sets for each module that has been faulty configured is stored in the head structure.

Byte offset	Data type			Description	
14 / 15	WORD			**Module slot with set / actual deviation**	
				Value range	1 ... 255
16 / 17	DWORD			**Identification of the physically connected modules**	
10 / 11					
12 / 13	WORD			**Module status**	
				0x0000	no module is connected
				0x0001	Physically connected and configured module do not correspond
				0x0002	Physically connected and configured module correspond but at least one sub-module is missing or does not correspond.
				0x0003	Physically connected and configured module do not correspond but are compatible
				0x0004 ... 0xFFFF	Reserved
14 / 15	WORD			**Number of sub-module slots where a difference between the target and actual configuration exists, otherwise 0**	

The data sets of faulty configured sub-modules are following the data set of one module.

Byte offset	Data type			Description	
14 / 15	WORD	0x00	0x01	**Sub-module slot with target and actual deviation**	
16 / 17	DWORD	0x00	0x00	**Identification of the physically connected sub-module = 0**	
10 / 11		0x00	0x00		
12 / 13	WORD			**Sub-module status**	
				0x0000	no sub-module is connected
				0x0001	Physically connected and configured sub-module do not correspond
				0x0002	Sub-module is locked by the IO controller
				0x0003	Reserved
				0x0004	one application is accessing the sub-module
				0x0005	Reserved
				0x0006	Reserved
				0x0007	Physically connected and configured sub-module do not correspond but are compatible
				0x0008 ... 0xFFFF	Reserved

The sub-module data sets follow direct one after another. Their number is stored in the head structure. The next module data set follows after the sub-module data sets.

3.1.8.2.4 Data Set for Identification and Servicing Purposes (I&M 0)

This data set allows to read the device information that may be required for the system documentation and for service purposes.

Byte offset	Information		Description
0	0x00	0x20	Block type
2	0x00	0x38	Block length = 56 Byte
4	0x01	0x00	Block version 1.0
6	0x01	0x1D	Manufacturer ID WAGO **285**$_{\mathbf{D}}$
8	**0x37**	**0x35**	WAGO order number filled out with blanks „750-370 “
10	**0x30**	**0x2D**	
12	**0x33**	**0x37**	
14	**0x30**	0x20	
16	0x20	0x20	
...	...	...	
26	0x20	0x20	
28	**0x30**	**0x30**	MAC-ID WAGO filled out with blanks “**0030DE*KLMNOP*** ”
30	**0x33**	**0x30**	
32	**0x44**	**0x45**	
34	**0xKK**	**0xLL**	
36	**0xMM**	**0xNN**	
38	**0xOO**	**0xPP**	
40	0x20	0x20	
42	0x20	0x20	
44	0x00	0xHH	Hardware version HH
46	0x56	0xAA	Firmware version ’V’ AA.BB.CC
48	0xBB	0xCC	
50	0x00	0x01	
52	0x00	0x00	
54	0x00	0x00	
56	0x01	0x01	
58	0x00	0x00	Only I&M0 is supported

3.1.9 Acyclic Communication using Record Data Sets

In addition to cyclic data communication (PROFIBUS IO standard in compliance with IEC 61158), PROFIBUS IO also offers acyclic communication services as an option. These acyclic services run parallel to cyclic data transfer. The data sets are addressed via the module slots, the sub-module slots and the data set number (index) of the module. In doing so, the sub-module slot should always be addressed with 1. The meaning of the indexes can be determined in the area of 0x0000 to 0x7FFF according to the manufacturer specifications. The area of 0x8000 to 0xFFFF is established by the PROFINET IO standard and the following applications.

3.1.9.1 Detailed Diagnostic Data Sets for PROFIsafe I/O Modules

Via channel diagnostics, the PROFIsafe I/O modules indicate if a fault has occurred and if it has been caused by a module or channel failure. In the event of a channel failure, the detailed diagnostics is made available at “record data” set 0x0024 (36) for the input channel and at “record data" set 0x002C (44) for the output channel. Detailed module faults can be determined via “record data” set 0x0034 (52). The length of the detailed diagnostics that must be requested is 2 bytes. The coding of the detailed diagnostics is as follows:

Detailed diagnostics “F Input channels PROFIsafe” (Data set 36, 2 Byte long)	
Error code	**Description**
0x0K01	Cross connection between two input channels that are supplied from two different clock signal sources. K contains the number of the input channel that does not receive a clock signal because of the cross connection. If there is a cross connection between two independent clock signal sources, K is written to the input channel that had recognized the fault at first.
0x0K27	Discrepancy fault with 2 channel evaluation. K contains the input channel that has determined the discrepancy fault.

Detailed diagnostics “F Output channels PROFIsafe” (Data set 44, 2 Byte long)	
Error code	**Description**
0x0K04	Overload to output channel K.
0x0K06	Wire break on output channel K.
0x0K23	Short circuit after 24 V of the output channel K.
0x0K24	Short circuit after 0 V of the output channel K.

Detailed diagnostics "F Module PROFIsafe" (Data set 52, 2 Byte long)	
Error code	**Description**
0x0002	Undervoltage field supply
0x0005	Excessive temperature within the PROFIsafe I/O module
0x0009	Fault
0x0019	Safety relevant fault, a hardware fault has occurred on safety relevant switching parts or there is a program sequence fault caused by the device software.
0x0020	External fault, there is a fault in the detail diagnostics for the input or output periphery.

Notice
For the 750-370 Fieldbus Coupler with firmware 03 or later, detail diagnostics must no longer be read via the corresponding dataset. They are directly made available as channel diagnostics.

3.1.10 Information about the Web-Based Management System (WBM)

HTML pages containing information and setting options are stored in the controller and referred to as the Web-based management system. Access these pages via hyperlinks in the left navigation bar of the browser window.

Information

Click the “Information” link to view controller and network status information.

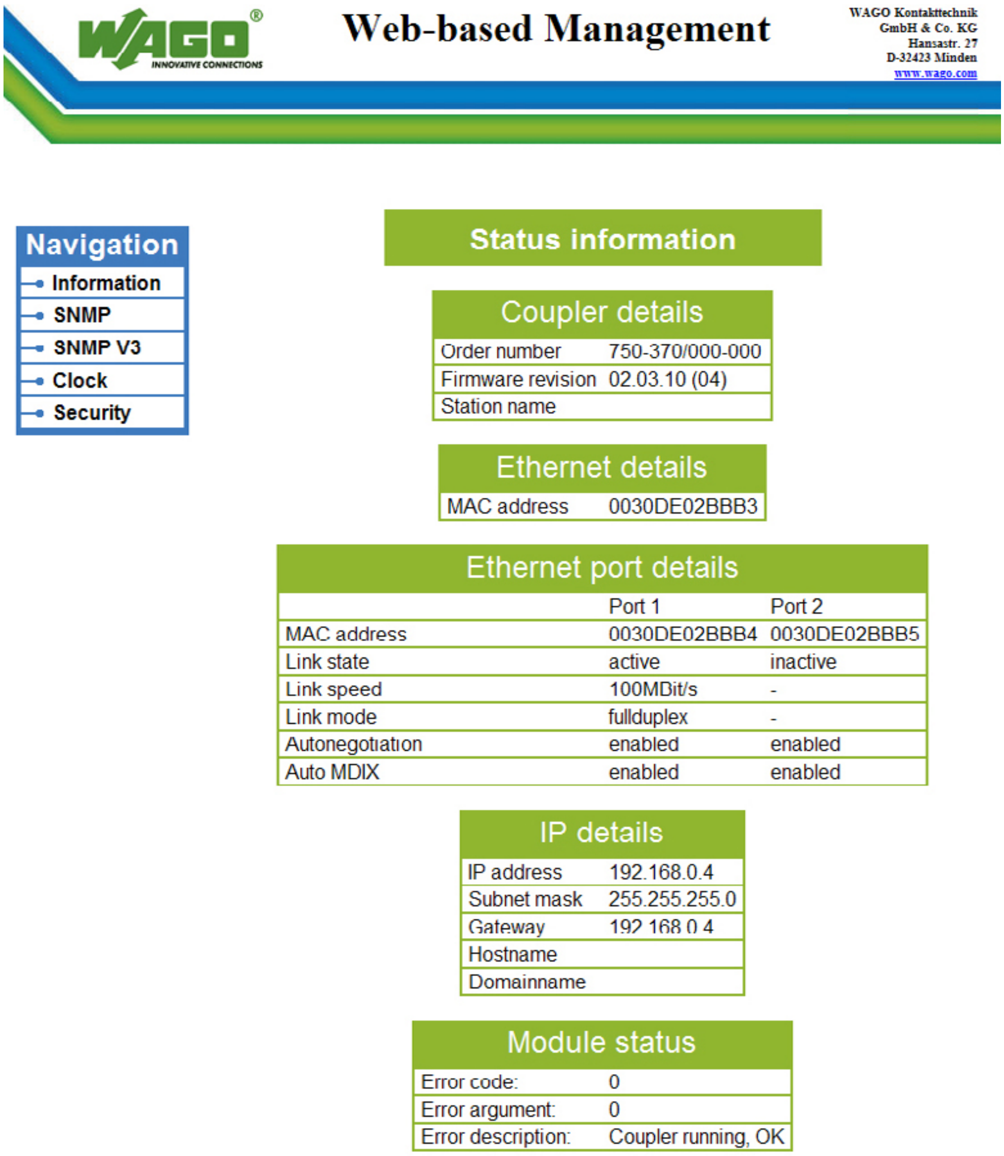


Fig. 3.1.10-10: Web.based Management - Information

SNMP

Click the “SNMP” link to access a Web page in order to specify **S**imple **N**etwork **M**anagement **P**rotocol settings. This protocol can be used for control and diagnostic information data exchange.

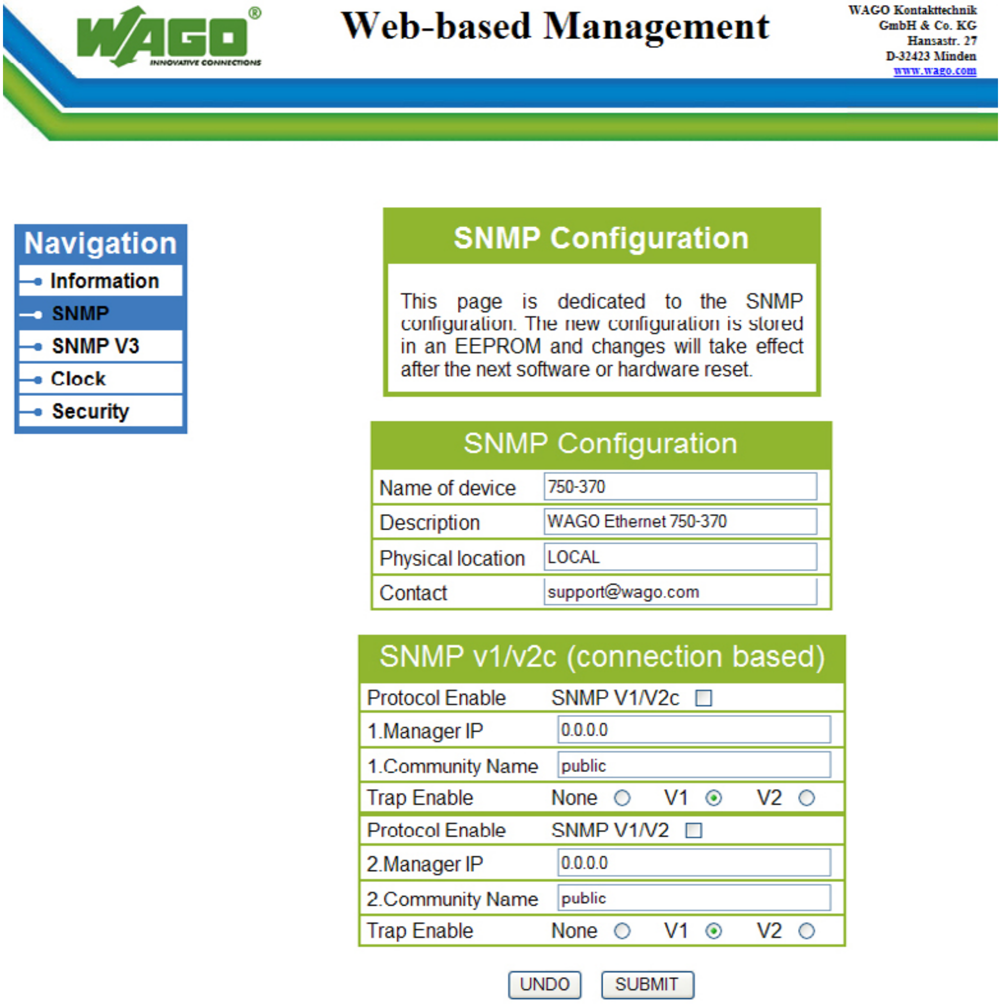


Fig. 3.1.10-11: Web-based management - SNMP

Additional information

For detailed information about how to set up and configure SNMP, see the section “SNMP Configuration.”

SNMP V3

Click the “SNMPV3” link to access a Web page in order to specify **S**imple **N**etwork **M**anagement **P**rotocol V3 (user based) settings. This protocol can be used for control and diagnostic information data exchange.

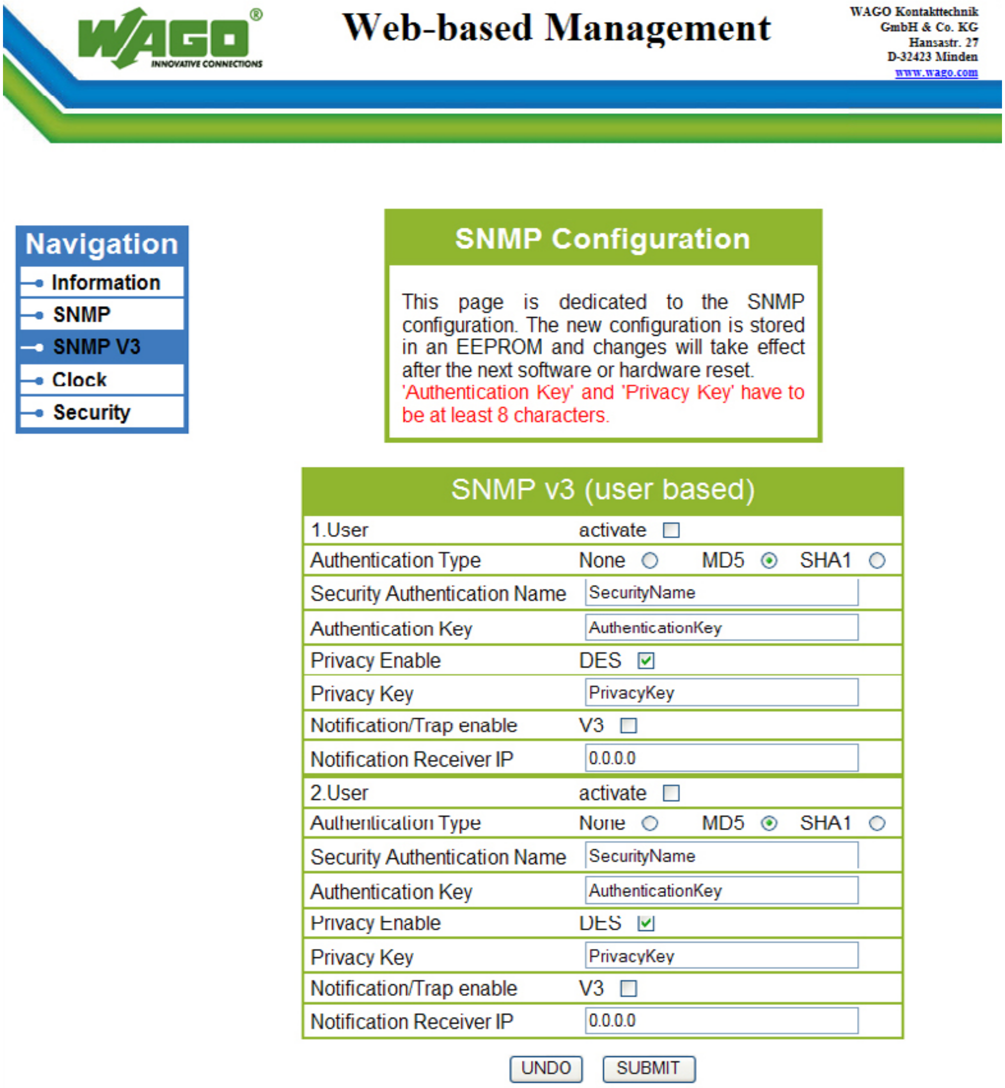


Fig. 3.1.10-12: Web-based management - SNMP V3

Clock

Click the “Clock” link to access a Web page in order to perform settings for the controller's internal real-time clock.

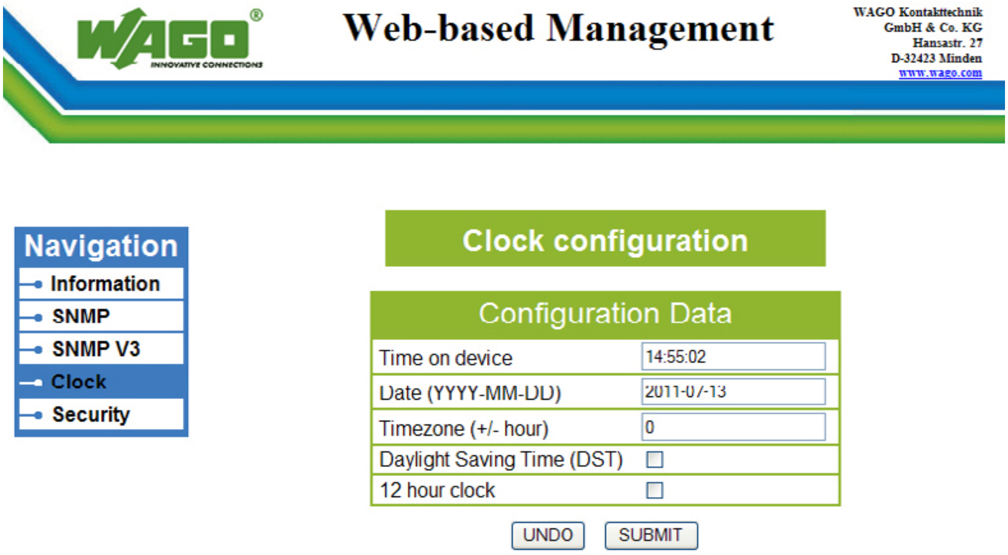


Fig. 3.1.10-13: Web-based management - Clock

Synchronize clock time by configuring the SNTP client. To do this, set the following parameters:

Parameter	Indicates
Address of the time server	The address assignment can be performed via an IP address or a host name.
Time zone	To operate the Ethernet coupler/controller with SNTP internationally, a time zone must be specified. The setting of the time zone is relative to GMT (Greenwich Mean Time). A range of -12 to +12 hours can be specified.
Update Time	The update time specifies (in seconds) the intervals that the synchronization with the timeserver should occur in.
Enable Time Client	Specifies whether the SNTP client should be activated or deactivated.

Security

Click the “Security” link to access a Web page where, using passwords, read and/or write access can be set up for various user groups to prevent configuration changes.

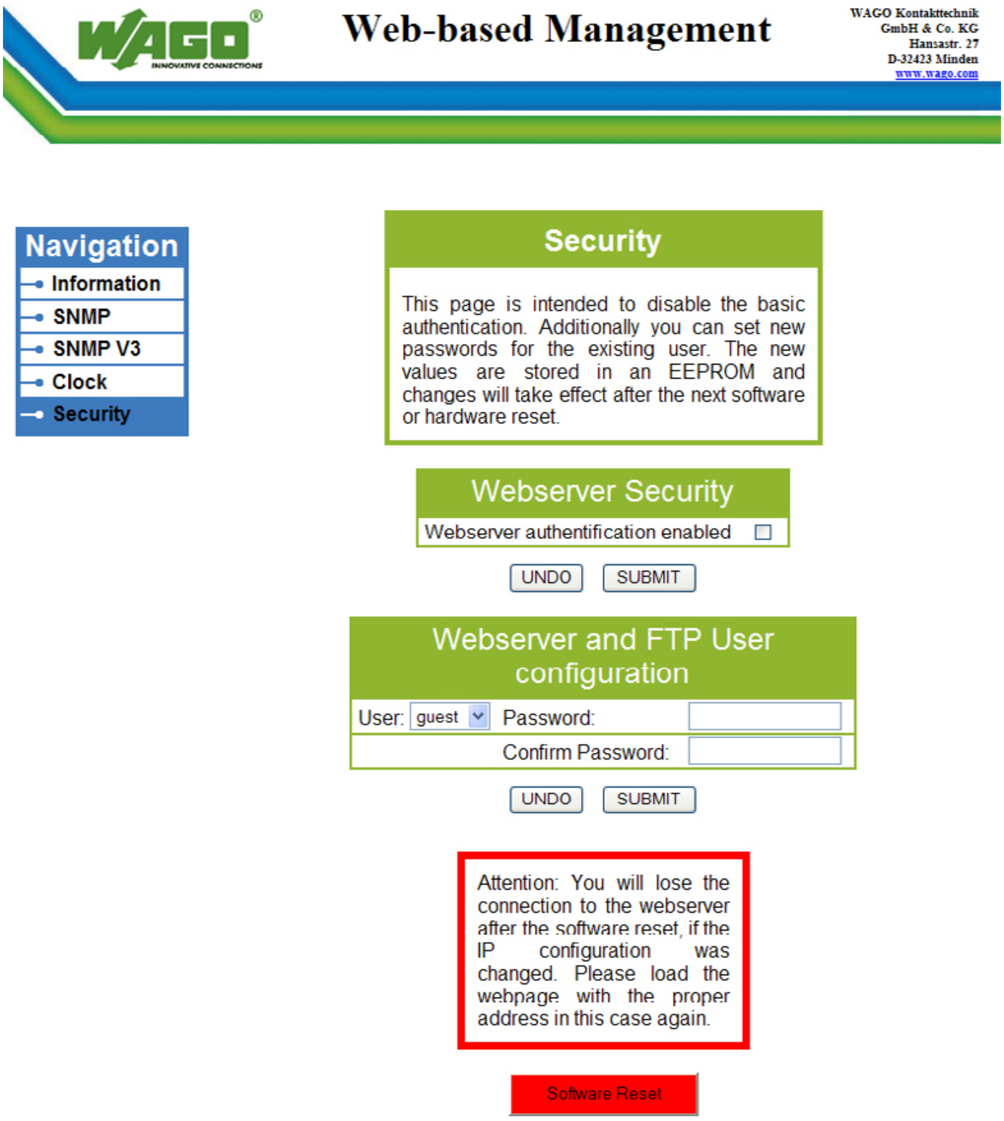


Fig. 3.1.10-14: Web-based management - Security

The following groups exist:

User	Password	Authorization
admin	wago	Read, write values and access to the security settings
user	user	Read, write values and trigger software reset, but cannot change the security settings
guest	guest	Read only

Passwords can only be changed by the “admin” user with the appropriate password. A software reset is required changes to take effect.

Click the “Software Reset” button to start a software reset of the coupler.

Attention
The following restrictions apply to passwords: max. of 16 characters, only letters and digits, no special characters, symbols or umlauts.

3.1.11 SNMP configuration

The **S**imple **N**etwork **M**anagement **P**rotocol (SNMP) transports the control data that allows information exchange (e.g., status and statistic data), between individual network components and a management system.

SNMP is supported in version 1, 2c and 3 and represents a standard for device management on a TCP/IP network. An SNMP management workstation polls the SNMP agents to obtain information about the corresponding devices.

In SNMP versions 1 and 2c, the exchange of messages is device-related, which requires the IP address of the SNMP manager to be specified. This IP address makes communication between SNMP manager and controller possible.

In SNMP version 3, message exchanges are user-related. Each device that knows the passwords set via WBM may read or write values from the controller. With SNMPv3, transmitted data can also be encrypted. SNMPv3 is frequently used on security-relevant networks as encryption prevents the requested values, and those to be written, from being obtained by unauthorized users.

The device data that can be accessed or modified by an SNMP agent is called a SNMP object. The sets of SNMP objects are stored in a logical database called Management Information Base (MIB), which is why these objects are typically known as “MIB objects.” The SNMP of the ETHERNET controller includes both the general MIB according to RFC1213 (MIB II) and a special WAGO MIB. Configuration of this protocol is performed via Web-Based Management (WBM) using the “Snmp” link or directly via SNMP.

3.1.11.1 Settings via WBM

SNMP is processed via port 161. The port number for SNMP traps (agent messages) is 162. These ports must first be enabled in WBM in menu “Port” so the controller can be reached via SNMP. The port numbers cannot be modified.

The “Snmp” Web page is used for configuring SNMP functionalities. However, parameters of the Web page that can be set can also be changed directly by the appropriate SNMP objects.

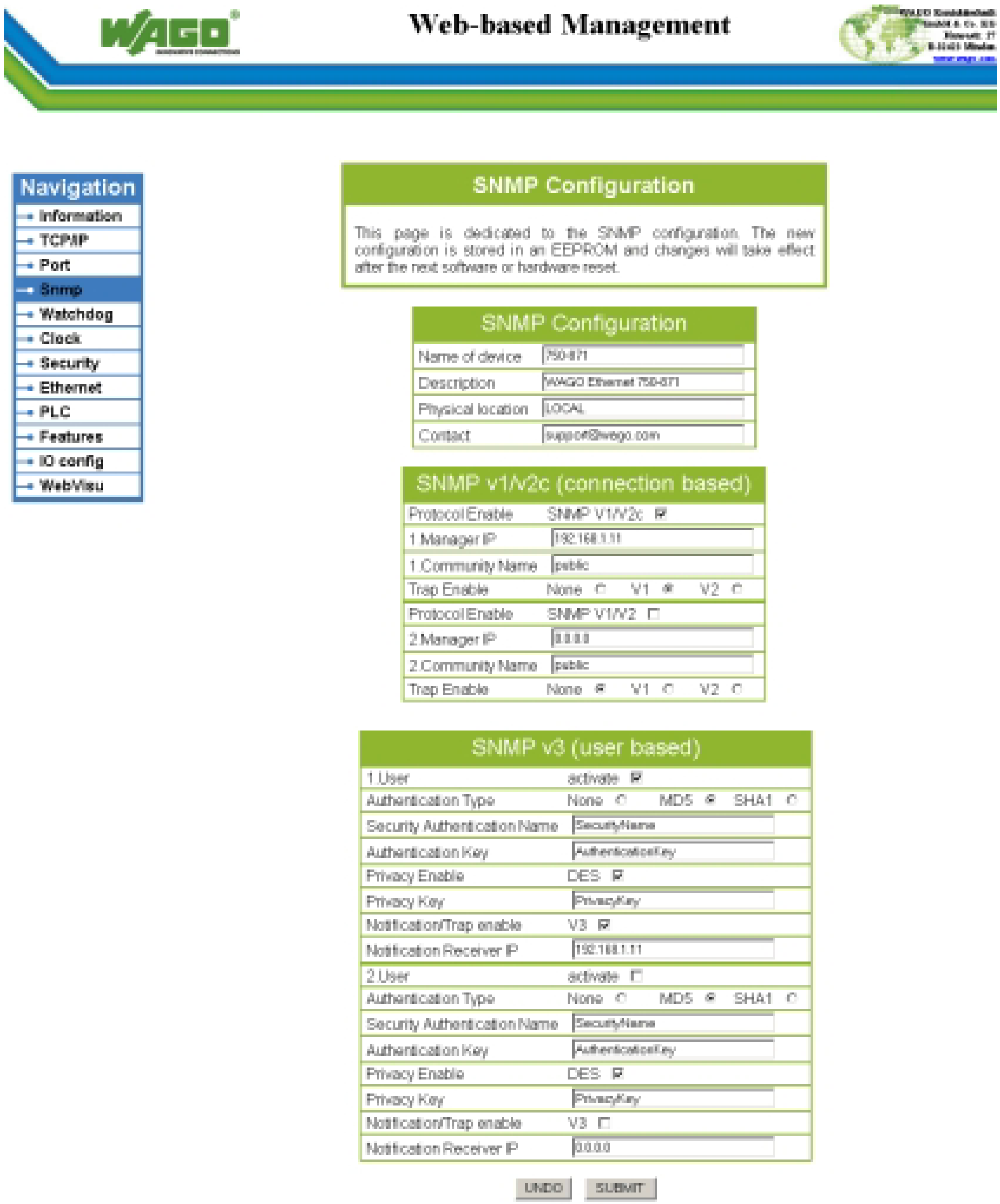


Fig. 3.1.11-15: Web-based Management p037001x

During “SNMP Configuration,” both the device name (sysName) and device description (sysDescription), as well as location (sysLocation) and contact (sysContact), can be set.

In the “SNMP v1/v2c (connection-based)” header, the following can occur:

- first, the connection can be enabled
- the IP address of the SNMP manager used can be set
- the community string can be defined
- and traps/notifications in versions 1 and 2c can be switched independently

These settings can be configured for two independent SNMP managers.

SNMPv3 settings are made in the “SNMPv3 (user-based)” area. First, the user can be activated under “activate.” If an “Authentication Type” is selected as encryption of the authentication, then both a “Security Authentication Name” and an “Authentication Key” must be entered. In addition, user data encryption can be activated via “DES.” The “Privacy Key” is used for encrypting with DES. Notifications can be activated in SNMPv3 by selecting “Notification/Trap enable V3”; to do this, the IP address of the notification manager must be entered in “Notification Receiver IP”.

Two independent SNMPv3 users can be defined and activated via Web page.

SNMPv1/v2c and SNMPv3 settings must remain independent. The different SNMP versions can be activated/used either simultaneously or individually on a controller.

3.1.11.2 MIB II description

MIB II, according to RFC1213, is divided into the following groups:

Group	Identifier
• System Group	1.3.6.1.2.1.1
• Interface Group	1.3.6.1.2.1.2
• IP Group	1.3.6.1.2.1.4
• IpRoute Table	1.3.6.1.2.1.4.21
• ICMP Group	1.3.6.1.2.1.5
• TCP Group	1.3.6.1.2.1.6
• UDP Group	1.3.6.1.2.1.7
• SNMP Group	1.3.6.1.2.1.11

Additional information
For detailed information about these individual groups, please refer to the section “MIB II Groups” in the manual appendix.

3.1.11.2.1 Standard traps

For specific events, the SNMP agent will independently send one of the following messages without polling the manager. However, this function must first be activated via WBM. Traps in version 1 — and notifications in both versions 2c and 3 — may be activated separately.

The following messages are triggered automatically as traps (SNMPv1) by the controller:

TrapType/ TrapNumber/ OID of the provided value	Name	Event
TrapType = 0	ColdStart	Restart the controller
TrapType = 1	WarmStart	Reset via service switch
TrapType = 3	EthernetUp	Network connection detected
TrapType = 4	AuthenticationFailure	Unauthorized (abortive) MIB access
TrapType = 6/ from trap number 25 user-specific	enterpriseSpecific	Enterprise-specific messages and function poll in the PFC program starting with enterprise trap number 25

3.1.12 LED Indication

For on-site diagnostics, the coupler has several LEDs that indicate the operational status of the coupler or the entire node.

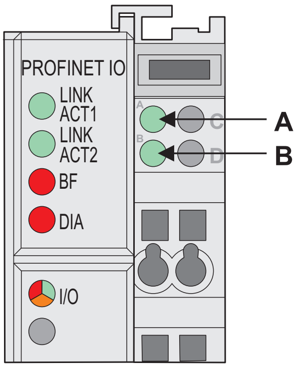


Fig. 3.1.12-16: Indicates 750-370 g037002x

The upper four LEDs (LNK/ACT 1, LNK/ACT 2, BF, DIA) indicate the state of the PROFINET IO communication.

The lower LED (I/O) displays the internal state of the complete node.

The LEDs A and B display the status of the supply voltage.

3.1.12.1 Blink Code

Detailed error messages are indicated by means of blinking codes. An error is indicated cyclically by up to 3 blinking sequences.

- The error display starts with the first blinking sequence (approx. 10 Hz).
- After a short break, the second blinking sequence starts (approx. 1 Hz). The number of light pulses indicates the **Error Code**.
- After another break, the third blinking sequence starts (approx. 1 Hz). The number of light pulses indicates the **Error Argument**.

3.1.12.2 Fieldbus Status

The upper four LEDs signal the operating status of the PROFIBUS IO communication.

LED	Color	Significance
LNK ACT 1	green	LNK/ACT LEDs provide information on each port connection to the PROFINET IO network and identify the station via MAC address (2 Hz blink frequency when I/O supervisor requests the participant blink test).
LNK ACT 2	green	
BF	red	The BF LED shows information on the condition of the data exchange between the buscoupler and the IO controller.
DIA	red	The DIA LED shows parameter setting faults and external diagnostics.

LNK ACT	BF	DIA	Significance	Remedy
Off	Off	Off	The buscoupler is not provided with its required operating voltage or a hardware fault is present.	Check the voltage supply to the bus coupler. Replace the buscoupler if necessary.
Off	On	*	The operating voltage for the buscoupler is present. The physical connection to the PROFINET IO network is not established.	Make sure that the RJ-45 socket is connected to the switch using a CAT 5 Ethernet cable.
On	On	*	A physical connection is not established between the buscoupler and IO controller.	Establish a connection between the buscoupler and IO controller via the network.
On	blinks	*	The physical network connection to the IO controller is established. However, data exchange could not be carried out.	Check the device names that have been allocated to the device. Check the configuration of IO device.
On	Offs	*	The buscoupler is performing a productive data exchange with the IO controller. Configuration and parameter setting has been taken over by the buscoupler.	
*	*	On	The buscoupler reports a diagnostic information which is still present.	The data exchange works trouble free. A diagnostic information such as cable break on an analog input module is active.
* not relevant				

3.1.12.3 Node Status - 'I/O' LED Blinking Code

The communication status via internal bus is indicated via the lower “I/O” LED.

LED	Significance	Remedy
I/O		
Green	Fieldbus coupler operates correctly	
Red	a) At fieldbus coupler start-up: Initialization of internal bus, start-up is indicated by fast blinking for approx. 1-2 seconds	
Rot	b) After fieldbus coupler start-up: Internal bus errors are indicated by up to three successive blinking sequences. Between the sequences are short inter-vals.	Analyze error message (error code and error argument)

After the power is turned on, the coupler starts up. The red ‘I/O‘ LED blinks. After a trouble-free start-up the ‘I/O‘ LED is green.
In the event of a failure the ‘I/O‘ LED keeps blinking.

Detailed error messages are indicated by means of blinking codes. An error is indicated cyclically by up to 3 blinking sequences.

- The error display starts with the first blinking sequence (approx. 10 Hz).
- The second flash sequence appears after an interval (approx. 1 Hz). The number of light pulses indicates the **Error Code**.
- After another break, the third blinking sequence starts (approx. 1 Hz). The number of light pulses indicates the **Error Argument**.

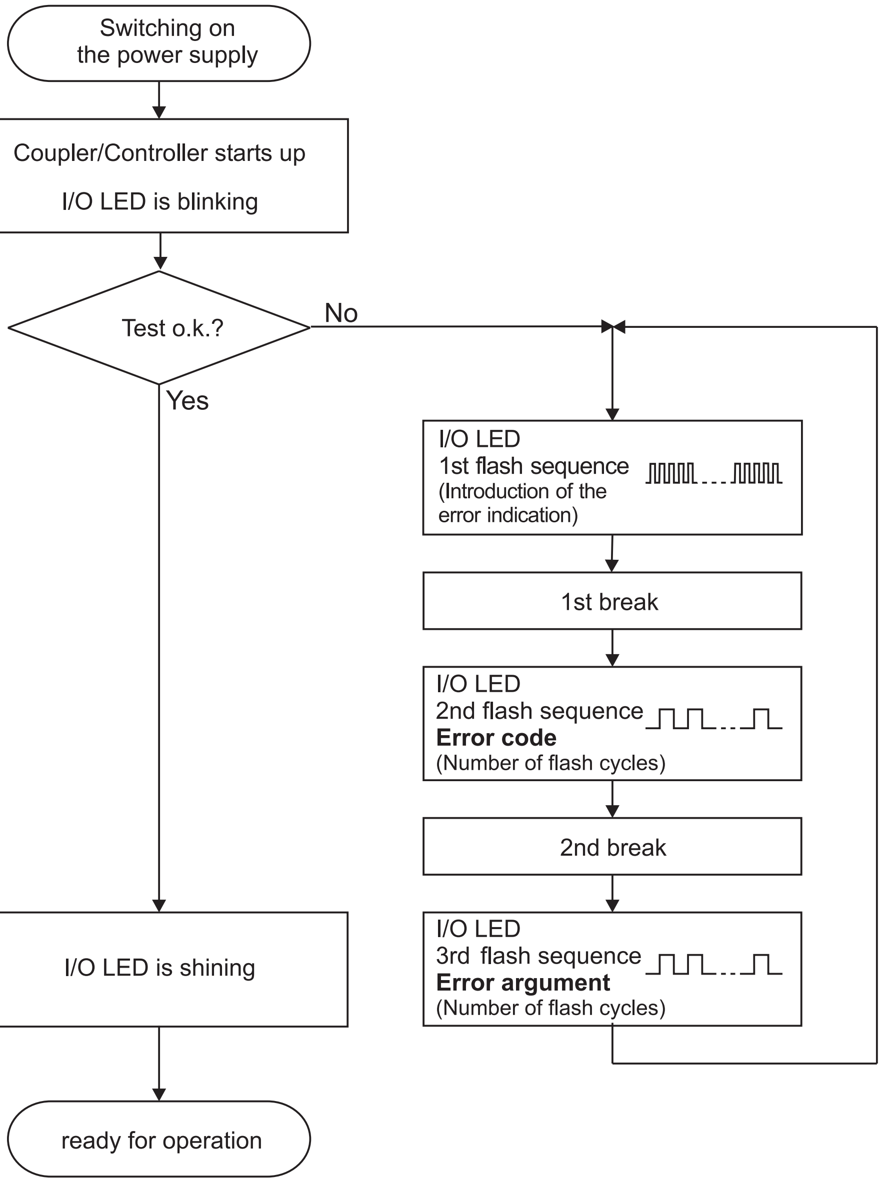


Fig. 3.1.12-17: Signaling the LED node status g012111e

After the error is removed, restart the coupler by turning the power supply off and on again.

3.1.12.4 'I/O' LED Error Messages

First blinking sequence: start of error display
Second blinking sequence: error code
Third blinking sequence: error argument

Error code 1: “Hardware and configuration error”		
Error argument	**Fault Description**	**Remedy**
1	Overflow of the internal buffer memory for the inline code.	Turn off the supply voltage of the node, reduce the number of modules and switch on the supply voltage again. If the error remains, replace the buscoupler.
2	I/O module(s) with unknown data type	Identify the faulty I/O module. Turn off the power supply. Plug the end module in the middle of the node. Turn the power supply on again. - If the LED is keeps blinking, turn off the power supply and plug the end module in the middle of the first half of the node (towards the coupler). - If the LED does not blink, turn off the power supply and plug the end module in the middle of the second half of the node (away from the coupler). Turn the power supply on again. Repeat this procedure (while halving the step size) until the faulty I/O module is detected. Replace the faulty I/O module. Ask for a buscoupler firmware update.
3	Invalid check sum in the parameter area of the buscoupler.	Switch off the supply voltage of the node, replace the buscoupler and switch on again.
4	Fault when writing in the serial EEPROM.	Switch off the supply voltage of the node, replace the buscoupler and switch on again.
5	Fault when reading the serial EEPROM.	Switch off the supply voltage of the node, replace the buscoupler and switch on again.
6	Changed I/O module configuration found after AUTORESET.	Restart the coupler by turning the supply voltage off and on again.
7	Invalid hardware-firmware combination.	Switch off the supply voltage of the node, replace the buscoupler and switch on again.
8	Zeitüberschreitung beim Zugriff auf das serielle EEPROM	Switch off the supply voltage of the node, replace the buscoupler and switch on again.
9	Buscontroller initialization error	Switch off the supply voltage of the node, replace the buscoupler and switch on again.

10	Buffer power failure real time clock (RTC)	Set the clock and hold up the power supply of the buscoupler for at least 15 minutes in order to charge the Goldcap.
11	Fault during read access to the real time clock (RTC)	Set the clock and hold up the power supply of the buscoupler for at least 15 minutes in order to charge the Goldcap.
12	Fault during write access to the real time clock (RTC)	Set the clock and hold up the power supply of the buscoupler for at least 15 minutes in order to charge the Goldcap.
13	Clock interrupt fault.	Set the clock and hold up the power supply of the buscoupler for at least 15 minutes in order to charge the Goldcap.
14	Maximum number of gateway modules or mailbox modules exceeded.	Reduce the number of correspon-dent modules to a valid number.

Error code 2 -not used-		
Fault Argument	**Fault Description**	**Remedy**
-	Not used	-
Error code 3 “Protocol error internal bus”		
Fault Argument	**Fault Description**	**Remedy**
-	Internal bus communication is faulty, defective component cannot be identified.	If there are passive power supply modules (750-613) in the node, check first if these modules are supplied correctly with power. To do so, check the status LEDs. If all modules are connected correctly or if there are no 750-613 I/O modules in the node, identify the faulty I/O module as follows: Turn off the supply voltage of the node. Plug the end module in the middle of the node. Turn on the power supply again. - If the LED keeps blinking, turn off the power supply and plug the end module in the middle of the first half of the node (towards the coupler). - If the LED does not blink, turn off the power supply and plug the end module in the middle of the second half of the node (away from the coupler). Turn on the power supply again. Repeat this procedure (while halving the step size) until the faulty I/O module is detected. Replace the faulty I/O module. If there is only one I/O module left and the LED blinks, then either this module or the coupler is defective. Replace the faulty component.

Fault code 4 “Physical error internal bus”		
Fault Argument	**Faukt Description**	**Remedy**
-	Internal bus data transmission error or interruption of the internal bus at the buscoupler.	Turn off the supply voltage of the node. Plug one I/O module with process data behind the coupler and observe the error argument that is indicated after power on. If no error argument is indicated by the I/O LED, replace the buscoupler. Otherwise identify the faulty I/O module. Turn off the power supply. Plug the end module in the middle of the node. Turn on the power supply again. - If the LED keeps blinking, turn off the power supply and plug the end module in the middle of the first half of the node (towards the coupler). - If the LED does not blink, turn off the power supply and plug the end module in the middle of the second half of the node (away from the coupler). Turn the power supply on again. Repeat this procedure (while halving the step size) until the faulty I/O module is detected. Replace the faulty I/O module. If there is only one I/O module left and the LED blinks, then either this module or the coupler is defective. Replace the faulty component.
n*	Interruption of the internal bus behind the nth I/O module with process data.	Turn off the supply voltage of the node, replace the (n+1)th I/O module with process data and turn on the supply voltage again.

Error code 5 “Initialization error internal bus”		
Fault Argument	**Fault Description**	**Remedy**
n*	Error during register communication during internal bus initialization.	Switch off the supply voltage of the node, replace the n-th bus coupler with the process data and switch the power supply back on.
Error code 6 “Fieldbus specific error”		
Fault Argument	**Fault Description**	**Remedy**
1	Invalid MAC-ID	Switch off the supply voltage of the node, replace the buscoupler and switch on again.
2	Initialization error Ethernet hardware	Restart the buscoupler by turning the power supply off and on again. If the error remains, replace the buscoupler.
3	Initialization error TCP/IP stack	Restart the buscoupler by turning the power supply off and on again. If the error remains, replace the buscoupler.
4	Network configuration error (no IP address)	Check the settings of the BootP server.
5	Initialization error of an application protocol	Restart the buscoupler by turning the power supply off and on again.
6	Maximum process image size exceeded	Reduce the number of I/O modules.
7	IP address of the buscoupler is repeated several times in the network	Use an IP address that has not been used in the network.
8	Error during process image generation	Reduce the number of I/O modules on the node.
* The number of light pulses (n) indicates the position of the I/O module. I/O modules without data are not counted (e. g. supply modules without diagnostics)		

Example: The 13th I/O module is removed.	
1.	The I/O LED starts the error display with the first blinking sequence (approx. 10 Hz).
2.	After the first break, the second blinking sequence starts (approx. 1 Hz). The I/O LED blinks four times, thus indicating error code 4 (data error internal bus).
3.	After the second break, the third blinking sequence starts. The I/O LED blinks twelve times. Error argument 12 means that the internal bus is interrupted behind the twelfth I/O module.

3.1.12.5 Status Supply voltage

The power supply unit of the coupler has two green LEDs. The link upper LED (A) displays the status of the system supply. The left lower LED (B) reports the status of the field supply.

LED A	Significance	Remedy
Green	System supply OK	
Off	System supply missing	Check supply voltage (24 V and 0 V)

LED B	Significance	Remedy
Green	Field supply OK	
Off	Field supply missing	Check supply voltage (24 V and 0 V)

3.1.13 Error Response

3.1.13.1 Fieldbus Failure

A fieldbus failure is indicated if the IO controller switches off or if the Ethernet cable is interrupted. An error in the IO controller can also lead to a fieldbus failure

The red BF LED lights up.

When the fieldbus fails, the coupler can release the configurable substitute values of the I/O modules. A substitute value can be determined for each channel when configuring the outputs.

Substitute value strategy	**Value (bit orientated) Digital Output Modules**	**Value (byte orientated) Analog Output Modules**
Minimum value	0	0 or. 4 mA, -10 or. 0 V
Maximum value	1	20 mA, 10 V
Substitute value	0 or 1	0/4 ... 20 mA, -10/0 ... +10 V
Stop internal bus	Response determined by the I/O module	

The values are entered into the output process image by the coupler. With I/O modules that have a byte orientated data width (e.g. pulse width module), the substitute value is determined using the value range.

As soon as the fieldbus is reactivated, the process data is transmitted again and the outputs of the node are set accordingly.

3.1.13.2 Internal Bus Failure

An internal bus failure occurs, for example, if an I/O module is removed. If this error occurs during operation, the output modules react like during an internal bus stop. The input process image is set according to the configuration strategy.

The “I/O” LED flashes red. The buscoupler (IO device) generates a detailed diagnostic message.

When the I/O module fault is repaired, the buscoupler restarts according to the configured restart behavior. The process data is transmitted again and the outputs of the node are set accordingly.

3.1.14 Technical Data

System data	
Number of I/O modules	limited by PROFINET I/O specification
Transmission medium	Twisted Pair S-UTP 100 Ω CAT 5
Buscoupler connection	RJ-45
Max. length of fieldbus segment	100 m between switch and 750-370; max. length of network limited by PROFINET I/O specification
Baud rate	100 Mbit/s
Protocols	PROFINET IO, DCP, DHCP, SNMP
Technical Data	
Number of I/O modules	128
Digital signals Analog signals	max. 2048 (inputs and outputs) max. 128 (inputs and outputs)
Configuration possibilities	via PC
Voltage supply	DC 24 V (-15 % ... + 20 %)
Input current $_{max}$	500 mA at 24 V
Efficiency of the power supply	87 %
Internal current consumption	300 mA at 5 V
Total current for I/O modules	1700 mA at 5 V
Potential isolation	500 V system/supply
Voltage via power jumper contacts	DC 24 V (-15 % ... + 20 %)
Current via power jumper contacts $_{max}$	DC 10 A
Dimensions W x H* x D (* from upper edge of rail)	51 mm x 65 mm x 100 mm
Weidht	ca. 195 g
Accessories	
Miniature WSB Quick marking system	
Standards and regulations (see chapter 2.2)	
EMC Immunity to interference	acc. to EN 50082-2 (96), EN 61000-6-2 (99)
EMC Emission of interference	acc. to EN 50082-2 (94)
Approvals (see chapter 2.2)	
$_{C}UL_{US}$ (UL508)	E175199
Conformity marking	CE
$_{C}UL_{US}$ (ANSI/ISA 12.12.01)	Class I Div2 ABCD T4

The following Ex approvals have been granted to 750-370 fieldbus coupler/controller:

TÜV 07 ATEX 554086 X

I M2 Ex db I Mb
II 3 G Ex nAc IIC T4 Gc
II 3 D Ex tc IIIC T135°C Dc

Permissible operation temperature: $0\ °C \le T_A \le +60\ °C$

TÜV TUN 09.0001X

Ex db I Mb
Ex nAc IIC T4 Gc
Ex tc IIIC T135°C Dc

Permissible operation temperature: $0\ °C \le T_A \le +60\ °C$

4 Fieldbus Communication

4.1 ETHERNET

4.1.1 General

ETHERNET is a technology, which has been proven and established as an effective means of data transmission in the field of information technology and office communication. Within a short time ETHERNET has also made a successful breakthrough in the area of private PC networks throughout the world.

This technology was developed in 1972 by Dr. Robert M. Metcalfe, David R. Boggs, Charles Thacker, Butler W. Lampson, and Xerox (Stanford, Ct.). Standardization (IEEE 802.3) took place in 1983.

ETHERNET predominantly uses coaxial cables or twisted pair cables as a transmission medium. Connection to ETHERNET, often already existing in networks, (LAN, Internet) is easy and the data exchange at a transmission rate of 10 Mbps or for some couplers/controllers also 100 Mbps is very fast.

ETHERNET has been equipped with higher level communication software in addition to standard IEEE 802.3, such as TCP/IP (Transmission Control Protocol / Internet Protocol) to allow communication between different systems. The TCP/IP protocol stack offers a high degree of reliability for the transmission of information.

In the ETHERNET based (programmable) fieldbus couplers and controllers developed by WAGO, usually various application protocols have been implemented on the basis of the TCP/IP stack.

These protocols allow the user to create applications (master applications) with standardized interfaces and transmit process data via an ETHERNET interface.

In addition to a series of management and diagnostic protocols, fieldbus specific application protocols are implemented for control of the module data, depending upon the coupler or controller, e. g. MODBUS TCP (UDP), EtherNet/IP, BACnet/IP, KNXNET/IP, PROFINET, Powerlink, SERCOS III or others.

Information such as the fieldbus node architecture, network statistics and diagnostic information is stored in the ETHERNET (programmable) fieldbus couplers and controllers and can be viewed as HTML pages via a web browser (e.g., Microsoft Internet-Explorer, Netscape Navigator) being served from the HTTP server in the couplers and controllers.

Furthermore, depending on the requirements of the respective industrial application, various settings such as selection of protocols, TCP/IP, internal clock and security configurations can be performed via the web-based management system. However, you can also load web pages you have created yourself into the couplers/controllers, which have an internal file system, using FTP.

The WAGO ETHERNET TCP/IP fieldbus node does not require any additional master components other than a PC with a network card. So, the fieldbus node can be easily connected to local or global networks using the fieldbus connection. Other networking components such as hubs, switches or repeaters can also be used. However, to establish the greatest amount of "determinism" a switch is recommended.

The use of ETHERNET as a fieldbus allows continuous data transmission between the plant floor and the office. Connection of the ETHERNET TCP/IP fieldbus node to the Internet even enables industrial processing data for all types of applications to be called up world-wide. This makes site independent monitoring, visualization, remote maintenance and control of processes possible.

4.1.2 Network Architecture – Principles and Regulations

A simple ETHERNET network is designed on the basis of one PC with a network interface card (NI), one crossover connection cable (if necessary), one ETHERNET fieldbus node and one 24 V DC power supply for the coupler/controller voltage source.

Each fieldbus node consists of a (programmable) fieldbus coupler or controller and a number of needed I/O modules.

Sensors and actuators are connected to the digital or analog I/O modules on the field side. These are used for process signal acquisition or signal output to the process, respectively.

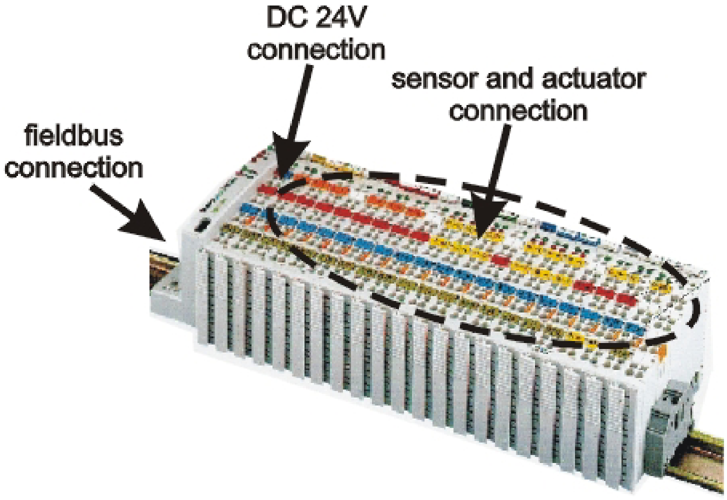


Fig. 4-1. Connection Example and Principle of a Fieldbus Node for a Network Architecture
1Netwerkknotene

Fieldbus communication between master application and (programmable) fieldbus coupler or controller takes place using the implemented fieldbus specific application protocol, e. g. MODBUS TCP (UDP), EtherNet/IP, BACnet, KNXNET/IP, PROFINET, Powerlink, SERCOS III or others.

4.1.2.1 Transmission Media

General ETHERNET transmission standards

For transmitting data the ETHERNET standard supports numerous technologies with various parameters (e.g., transmission speed, medium, segment length and type of transmission).

Tab. 4-1: ETHERNET Transmission Standards

1Base5	Uses a 24 AWG UTP (twisted pair cable) for a 1Mbps baseband signal for distances up to 500 m (250 m per segment) in a physical star topology.
10Base2	Uses a 5 mm 50 Ohm coaxial cable for a 10Mbps baseband signal for distances of up to 185 m in a physical bus topology (often referred to as Thin ETHERNET or ThinNet).
10Base5	Uses a 10 mm 50 Ohm coaxial cable for a 10Mbps baseband signal for distances of up to 500 m in a physical bus topology (often referred to as Thick ETHERNET).
10BaseF	Uses a fiber-optic cable for a 10Mbps baseband signal for distances of up to 4 km in a physical star topology. (There are three sub-specifications: 10BaseFL for fiber-optic link, 10BaseFB for fiber-optic backbone and 10BaseFP for fiber-optic passive).
10BaseT	Uses a 24 AWG UTP or STP/UTP (twisted pair cable) for a 10Mbps baseband signal for distances up to 100 m in a physical star topology.
10Broad36	Uses a 75 Ohm coaxial cable for a 10Mbps baseband signal for distances of up to 1800 m (or 3600 m with double cables) in a physical bus topology.
100BaseTX	Specifies a 100 Mbps transmission with a twisted pair cable of Category 5 and RJ45-connectors. A maximum segment of 100 meters may be used.

Beyond that there are still further transmission standards, for example: 100BaseT4 (Fast ETHERNET over twisted conductors), 100BaseFX (Fast ETHERNET over fiber-optic cables) or P802.11 (Wireless LAN) for a wireless transmission.

The media types are shown with their IEEE shorthand identifiers. The IEEE identifiers include three pieces of information.
The first item, for example, “10”, stands for the media.
The third part of the identifier provides a rough indication of segment type or length. For thick coaxial cable, the “5” indicates a 500 meter maximum length allowed for individual thick coaxial segments. For thin coaxial cable, the “2” is rounded up from the 185 meter maximum length for individual thin coaxial segments. The “T” and “F” stand for ‘twisted pair’ and ‘fiber optic’, and simply indicate the cable type.

10BaseT, 100BaseTX

Either the 10BaseT standard or 100BaseTX can be used for the WAGO ETHERNET fieldbus node.
The network architecture is very easy and inexpensive to assemble with S-UTP cable as transmission medium or with cables of STP type.
Both types of cable can be obtained from any computer dealer.

S-UTP cable (screened unshielded twisted pair) is single-shielded cable of Category 5 with overall shield surrounding all twisted unshielded conductor pairs and an impedance of 100 ohm.
STP cable (shielded twisted pair) is cable of Category 5 with stranded and individually shielded conductor pairs; no overall shield is provided.

Wiring of the fieldbus nodes

Maybe, a crossover cable is required for direct connection of a fieldbus node to the network card of the PC.

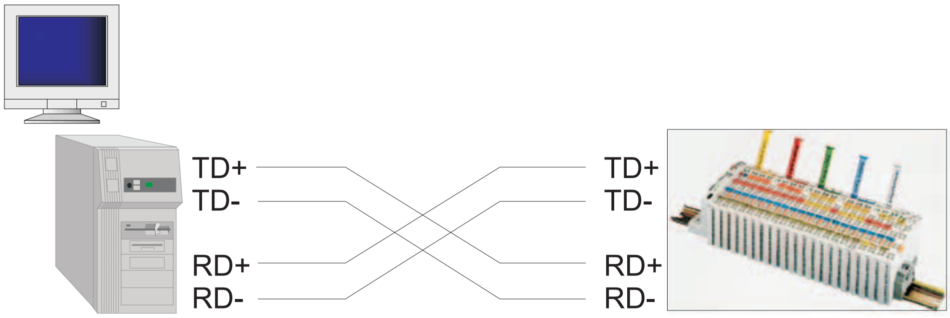


Fig. 4-2: Direct Connection of a Node with Crossover Cable g012906d

If several fieldbus nodes are to be connected to a network card, the fieldbus nodes can be connected via an ETHERNET switch or hub with straight through/parallel cables.

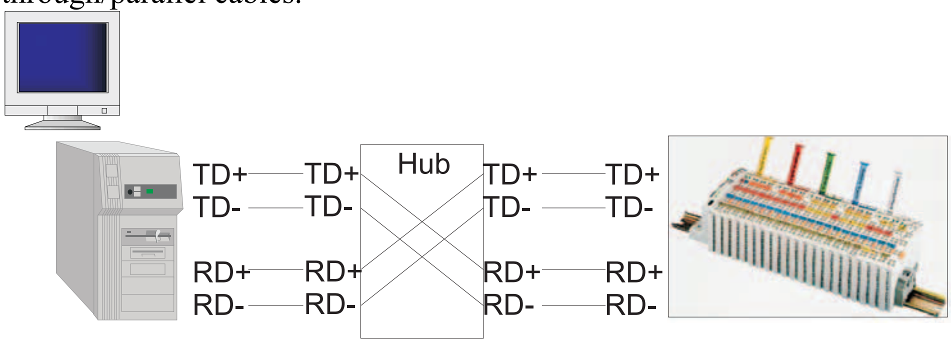


Fig. 4-3: Connection of a Node by means of a Hub with Parallel cables g012908d

An ETHERNET switch is a device that allows all connected devices to transmit and receive data with each other. The switch can also be viewed as a “data traffic cop” where the hub “polices” the data coming in and going out of the individual ports, so the data will only be transmitted to the required node. WAGO recommends using a switch rather then a hub, this will allow for a more deterministic architecture.

Attention
The cable length between the node and the hub cannot be longer than 100 m (328 ft.) without adding signal conditioning systems (i.e., repeaters). Various possibilities are described in the ETHERNET standard for networks covering larger distances.

4.1.2.2 Network Topologies

In the case of 10BaseT, or 100BaseTX several stations (nodes) are connected using a star topology according to the 10BaseT ETHERNET Standard.

Therefore, this manual only deals with the star topology, and the tree topology for larger networks in more detail.

Star Topology

A star topology consists of a network in which all nodes are connected to a central point via individual cables.

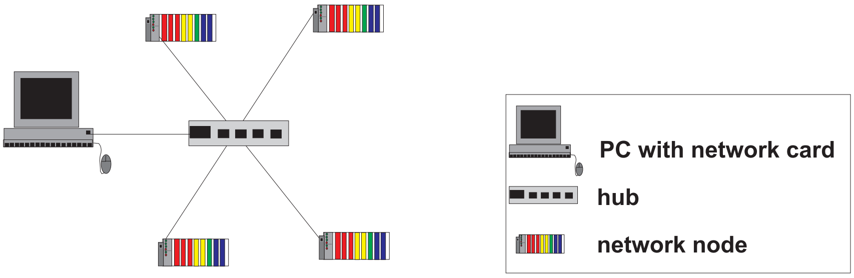


Fig. 4-4: Star Topology G012903e

A star topology offers the advantage of allowing the extension of an existing network. Stations can be added or removed without network interruption. Moreover, in the event of a defective cable, only the network segment and the node connected to this segment is impaired. This considerably increases the fail-safe of the entire network.

Tree Topology

The tree topology combines characteristics of linear bus and star topologies. It consists of groups of star-configured workstations connected to a linear bus backbone cable. Tree topologies allow for the expansion of an existing network, and enables schools, etc. to configure a network to meet their needs.

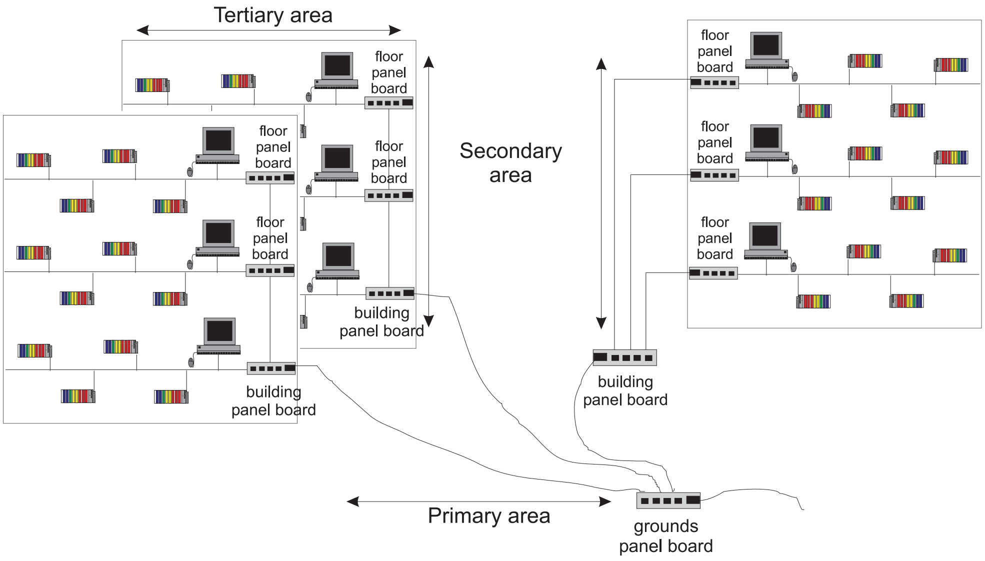


Fig. 4-5: Tree Topology G012904e

5-4-3 Rule

A consideration in setting up a tree topology using ETHERNET protocol is the
5-4-3 rule. One aspect of the ETHERNET protocol requires that a signal sent out on the network cable must reach every part of the network within a specified length of time. Each concentrator or repeater that a signal goes through adds a small amount of time. This leads to the rule that between any two nodes on the network there can only be a maximum of 5 segments connected through 4 repeators/concentrators. In addition, only 3 of the segments may be populated (trunk) segments if they are made of coaxial cable. A populated segment is one that has one or more nodes attached to it. In Figure 5-5, the 5-4-3 rule is adhered to. The furthest two nodes on the network have 4 segments and 3 repeators/concentrators between them.

This rule does not apply to other network protocols or ETHERNET networks where all fiber optic cabling or a combination of a backbone with UTP cabling is used. If there is a combination of fiber optic backbone and UTP cabling, the rule is simply translated to 7-6-5 rule.

Cabling guidelines

"Structured Cabling" specifies general guidelines for network architecture of a LAN, establishing maximum cable lengths for the grounds area, building and floor cabling.

The "Structured Cabling" is standardized in EN 50173, ISO 11801 and TIA 568-A. It forms the basis for a future-orientated, application-independent and cost-effective network infrastructure.

The cabling standards define a domain covering a geographical area of 3 km and for an office area of up to 1 million square meters with 50 to 50,000 terminals. In addition, they describe recommendations for setting up of a cabling system.

Specifications may vary depending on the selected topology, the transmission media and coupler modules used in industrial environments, as well as the use of components from different manufacturers in a network. Therefore, the specifications given here are only intended as recommendations.

4.1.2.3 Coupler Modules

There are a number of hardware modules that allow for flexible arrangement for setting up an ETHERNET network. They also offer important functions, some of which are very similar.

The following table defines and compares these modules and is intended to simplify the correct selection and appropriate application of them.

Module	**Characteristics/application**	**ISO/OSI layer**
Repeater	Amplifier for signal regeneration, connection on a physical level.	1
Bridge	Segmentation of networks to increase the length.	2
Switch	Multiport bridge, meaning each port has a separate bridge function. Logically separates network segments, thereby reducing network traffic. Consistent use makes ETHERNET collision-free.	2 (3)
Hub	Used to create star topologies, supports various transmission media, does not prevent any network collisions.	2
Router	Links two or more data networks. Matches topology changes and incompatible packet sizes (e.g. used in industrial and office areas).	3
Gateway	Links two manufacturer-specific networks which use different software and hardware (i.e., ETHERNET and Interbus-Loop).	4-7

Tab. 4-2: Comparison of Coupler Modules for Networks

4.1.2.4 Transmission Mode

Some ETHERNET based WAGO couplers/controllers support both 10Mbit/s and 100Mbit/s for either full or half duplex operation. To guarantee a safe and fast transmission, both these couplers/controllers and their link partners must be configured for the same transmission mode.

Attention
A faulty configuration of the transmission mode may result in a link loss condition, a poor network performance or a faulty behavior of the coupler/controller.

The IEEE 802.3u ETHERNET standard defines two possibilities for configuring the transmission modes:

Static configuration
Dynamic configuration

4.1.2.4.1 Static Configuration of the Transmission Mode

Using static configuration, both link partners are set to static transmission rate and duplex mode. The following configurations are possible:

10 Mbit/s, half duplex

10 Mbit/s, full duplex

100 Mbit/s, half duplex

100 Mbit/s, full duplex

4.1.2.4.2 Dynamic Configuration of the Transmission Mode

The second configuration option is the autonegotiation mode which is defined in the IEEE 802.3u standard. Using this mode, the transmission rate and the duplex mode are negotiated dynamically between both communication partners. Autonegotiation allows the device to automatically select the optimum transmission mode.

Attention
To ensure a correct dynamic configuration process, the operation mode for the autonegotiation of both communication partners must be supported and activated.

4.1.2.4.3 Errors Occurring when Configuring the Transmission Mode

Invalid configurations are listed below:

Problem	Cause	Symptoms
Mismatch of the transmission rate	Occurs when configuring one link partner with 10 Mbit/s and the other one with 100 Mbit/s.	Link failure
Duplex mode mismatch	Occurs when one link partner is running in full-duplex and the other in half-duplex mode.	Faulty or discarded data packets as well as collisions on the medium.
Mismatch using autonegotiation	Occurs when one link partner is running in auto-negotiation mode and the other one is using a static configuration of the transmission mode in full-duplex operation.	The link partner, which is in autonegotiation mode, determines the network speed via the parallel detection procedure and sets the duplex mode to half-duplex. If the device is operating in full-duplex mode with static configuration, a duplex mode mismatch will occur (see above).

4.1.2.5 Important Terms

Data security

If an internal network (Intranet) is to be connected to the public network (e.g., the Internet) then data security is an extremely important aspect.

Undesired access can be prevented by a **Firewall**.
Firewalls can be implemented in software or network components. They are interconnected in a similar way to routers as a switching element between Intranets and the public network. Firewalls are able to limit or completely block all access to the other networks, depending on the access direction, the service used and the authenticity of the network user.

Real-time ability

Transmission above the fieldbus system level generally involves relatively large data quantities. The permissible delay times may also be relatively long (0.1...10 seconds).
However, real-time behavior within the fieldbus system level is required for ETHERNET in industry.
In ETHERNET it is possible to meet the real-time requirements by restricting the bus traffic (< 10 %), by using a master-slave principle, or also by implementing a switch instead of a hub.
MODBUS/TCP is a master/slave protocol in which the slaves only respond to commands from the master. When only one master is used, data traffic over the network can be controlled and collisions avoided.

Shared ETHERNET

Several nodes linked via a hub share a common medium. When a message is sent from a station, it is broadcast throughout the entire network and is sent to each connected node. Only the node with the correct target address processes the message. Collisions may occur and messages have to be repeatedly transmitted as a result of the large amount of data traffic. The delay time in a Shared ETHERNET cannot be easily calculated or predicted.

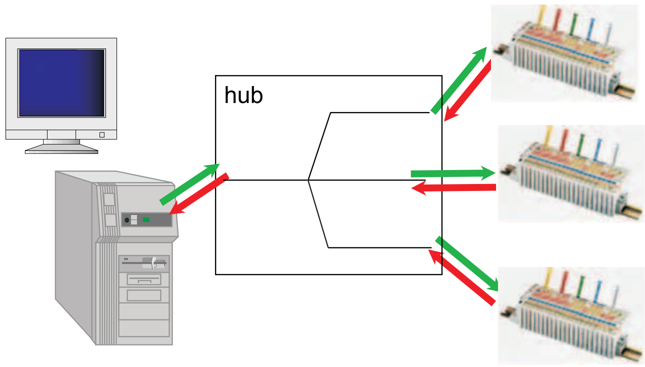


Fig. 4-6: Principle of Shared ETHERNET G012910e

Deterministic ETHERNET

The TCP/IP software or the user program in each subscriber can limit transmittable messages to make it possible to determine real-time requirements. At the same time the maximum medium message rate (datagrams per second), the maximum medium duration of a message, and the minimum time interval between the messages (waiting time of the subscriber) is limited.

Therefore, the delay time of a message is predictable.

Switched ETHERNET

In the case of Switched ETHERNET, several fieldbus nodes are connected by a switch. When data from a network segment reaches the switch, it saves the data and checks for the segment and the node to which this data is to be sent. The message is then only sent to the node with the correct target address. This reduces the data traffic over the network, extends the bandwidth and prevents collisions. The runtimes can be defined and calculated, making the Switched ETHERNET deterministic.

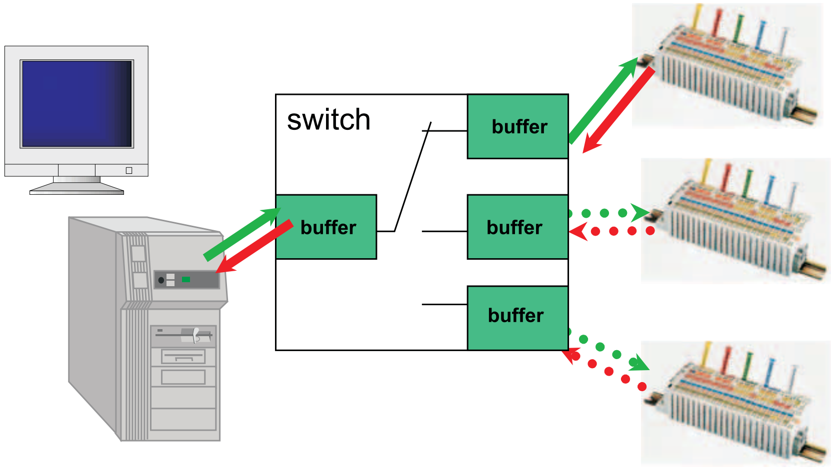


Fig. 4-7: Principle of Switched ETHERNET G012909e

4.1.3 Network Communication

Fieldbus communication between master application and (programmable) fieldbus coupler or controller usually takes place using an implemented fieldbus specific application protocol, e. g. MODBUS TCP (UDP), EtherNet/IP, BACnet, KNXNET/IP, PROFINET, Powerlink, SERCOS III or others.

The protocol layer model helps with an example (MODBUS and EtherNet/IP) to explain the classification and interrelationships between the communication and application protocols.
In this example, the fieldbus communication can take place using either the MODBUS protocol or EtherNet/IP.

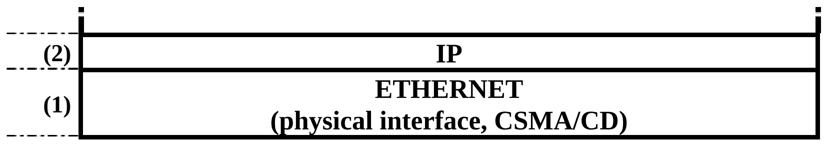
4.1.3.1 Protocol layer model

(1) ETHERNET:

The ETHERNET hardware forms the basis for the physical exchange of data. The exchanged data signals and the bus access procedure CSMA/CD are defined in a standard.

(2) IP:

For the communication the Internet Protocol (IP) is positioned above the ETHERNET hardware. This bundles the data to be transmitted in packets along with sender and receiver address and passes these packets down to the ETHERNET layer for physical transmission. At the receiver end, IP accepts the packets from the ETHERNET layer and unpacks them.

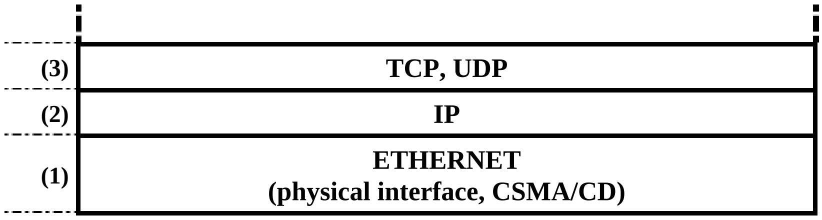


(3) TCP, UDP:

a) TCP: (Transmission Control Protocol)
The TCP protocol, which is positioned above the IP layer, monitors the transport of the data packets, sorts their sequence and sends repeat requests for missing packets. TCP is a connection-oriented transport protocol.
The TCP and IP protocol layers are also jointly described as the TCP/IP protocol stack or TCP/IP stack.

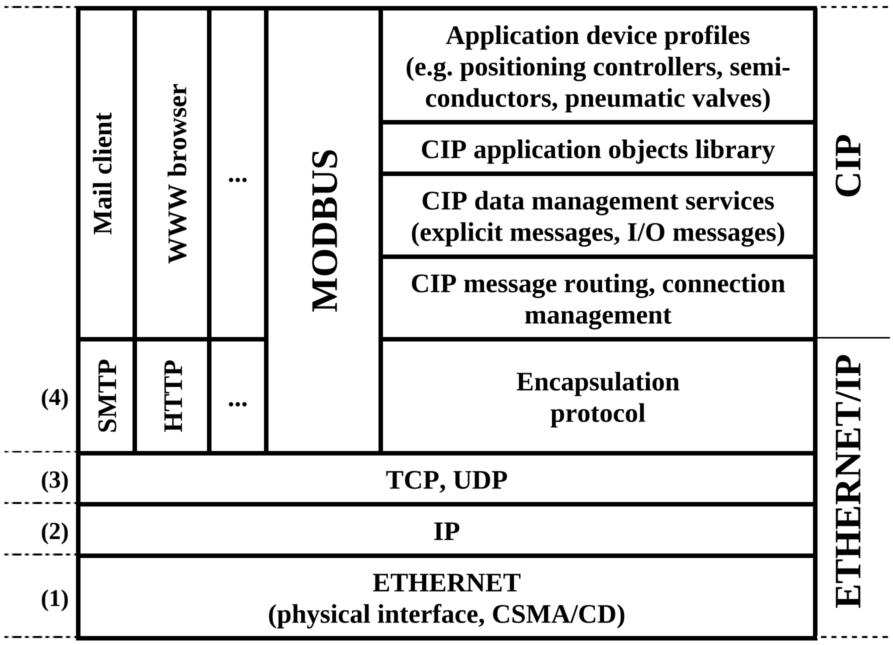
b) UDP: (User Datagram Protocol)
The UDP layer is also a transport protocol like TCP, and is arranged above the IP layer. In contrast to the TCP protocol, UDP is not connection oriented. That means there are no monitoring mechanisms for data exchange between sender and receiver.
The advantage of this protocol is in the efficiency of the transmitted

data and the resultant increase in processing speed.
Many programs use both protocols. Important status information is sent via the reliable TCP connection, while the main stream of data is sent via UDP.



(4) Management, Diagnostic and Application Protocols:

Positioned above the TCP/IP stack or UDP/IP layer are correspondingly implemented management, diagnostic and application protocols that provide services that are appropriate for the application. For the management and diagnostic, these are, for example, SMTP (Simple Mail Transport Protocol) for e-mails, HTTP (Hypertext Transport Protocol) for www browsers and some others.
In this example, the protocols MODBUS/TCP (UDP) and EtherNet/IP are implemented for use in industrial data communication.
Here the MODBUS protocol is also positioned directly above TCP (UDP)/IP; EtherNet/IP, on the other hand, basically consists of the protocol layers ETHERNET, TCP and IP with an encapsulation protocol positioned above it. This serves as interface to CIP (Control and Information Protocol).
DeviceNet uses CIP in the same way as EtherNet/IP. Applications with DeviceNet device profiles can therefore be very simply transferred to EtherNet/IP.



4.1.3.2 Communication Protocols

In addition to the ETHERNET standard, the following important communication protocols are implemented in the WAGO ETHERNET based (programmable) fieldbus couplers and controllers:

IP Version 4 (Raw-IP and IP-Multicast)

TCP

UDP

ARP

The following diagram is intended to explain the data structure of these protocols and how the data packets of the communication protocols ETHERNET, TCP and IP with the adapted application protocol MODBUS nested in each other for transmission. A detailed description of the tasks and addressing schemes of these protocols is contained in the following.

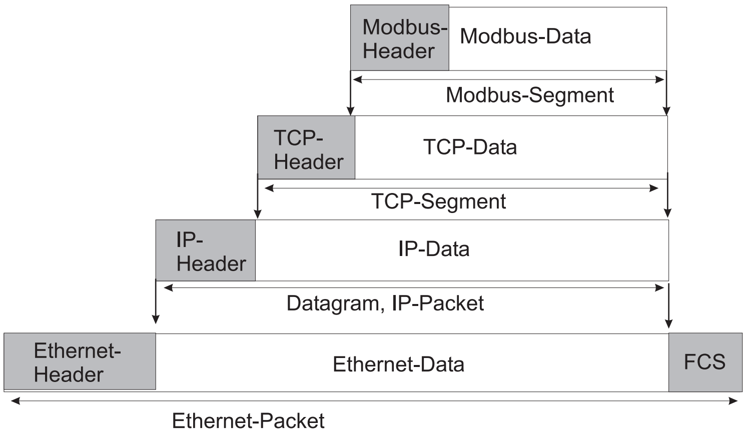


Fig. 4-8: Communication Protocols G012907e

4.1.3.2.1 ETHERNET

ETHERNET address (MAC-ID)

Each WAGO ETHERNET (programmable) fieldbus coupler or controller is provided from the factory with a unique and internationally unambiguous physical ETHERNET address, also referred to as MAC-ID (Media Access Control Identity). This can be used by the network operating system for addressing on a hardware level.
The address has a fixed length of 6 Bytes (48 Bit) and contains the address type, the manufacturer's ID, and the serial number.
Examples for the MAC-ID of a WAGO ETHERNET fieldbus coupler (hexadecimal): 00_H-30_H-DE_H-00_H-00_H-01_H.
ETHERNET does not allow addressing of different networks.
If an ETHERNET network is to be connected to other networks, higher-ranking protocols have to be used.

Attention
If you wish to connect one or more data networks, routers have to be used.

ETHERNET Packet

The datagrams exchanged on the transmission medium are called "ETHERNET packets" or just "packets". Transmission is connectionless; i.e. the sender does not receive any feedback from the receiver. The data used is packed in an address information frame. The following figure shows the structure of such a packet.

Preamble	ETHERNET Header	ETHERNET Data	Check sum
8 Byte	14 Byte	46-1500 Byte	4 Byte

Fig. 4-9: ETHERNET-Packet

The preamble serves as a synchronization between the transmitting station and the receiving station. The ETHERNET header contains the MAC addresses of the transmitter and the receiver, and a type field.
The type field is used to identify the following protocol by way of unambiguous coding (e.g., 0800_{hex} = Internet Protocol).

4.1.3.2.1.1 Channel access method

In the ETHERNET Standard, the fieldbus node accesses the bus using CSMA/CD (Carrier Sense Multiple Access/ Collision Detection).

- Carrier Sense: The transmitter senses the bus.
- Multiple Access: Several transmitters can access the bus.
- Collision Detection: A collision is detected.

Each station can send a message once it has established that the transmission medium is free. If collisions of data packets occur due to several stations transmitting simultaneously, CSMA/CD ensures that these are detected and the data transmission is repeated.

However, this does not make data transmission reliable enough for industrial requirements. To ensure that communication and data transmission via ETHERNET is reliable, various communication protocols are required.

4.1.3.2.2 IP-Protocol

The Internet protocol divides datagrams into segments and is responsible for their transmission from one network subscriber to another. The stations involved may be connected to the same network or to different physical networks which are linked together by routers.
Routers are able to select various paths (network transmission paths) through connected networks, and bypass congestion and individual network failures. However, as individual paths may be selected which are shorter than other paths, datagrams may overtake each other, causing the sequence of the data packets to be incorrect.
Therefore, it is necessary to use a higher-level protocol, for example, TCP to guarantee correct transmission.

IP addresses

To allow communication over the network each fieldbus node requires a 32 bit Internet address (IP address).

Attention
Internet addresses have to be unique throughout the entire interconnected networks.

As shown below there are various address classes with net identification (net ID) and subscriber identification (subscriber ID) of varying lengths. The net ID defines the network in which the subscriber is located. The subscriber ID identifies a particular subscriber within this network.
Networks are divided into various network classes for addressing purposes:

Class A: (Net-ID: Byte1, Host-ID: Byte2 - Byte4)

e.g.: 101 . 16 . 232 . 22

01100101		00010000	11101000	00010110
0	Net-ID	Host-ID		

The highest bit in Class A networks is always '0'.
Meaning the highest byte can be in a range of
'0 0000000' to '0 1111111'.

Therefore, the address range of a Class A network in the first byte is always between 0 and 127.

Class B: (Net-ID: Byte1 - Byte2, Host-ID: Byte3 - Byte4)

e.g.: 181 . 16 . 232 . 22

10110101		00010000	11101000	00010110
10	Net-ID		Host-ID	

The highest bits in Class B networks are always '10'.
Meaning the highest byte can be in a range of
'10 000000' to '10 111111'.

Therefore, the address range of Class B networks in the first byte is always between 128 and 191.

Class C: (Net-ID: Byte1 - Byte3, Host-ID: Byte4)

e.g.: 201 . 16 . 232 . 22

11000101		00010000	11101000	00010110
110	Net-ID			Host-ID

The highest bits in Class C networks are always '110'.
Meaning the highest byte can be in a range of
'110 00000' to '110 11111'.

Therefore, the address range of Class C networks in the first byte is always between 192 and 223.

Additional network classes (D, E) are only used for special tasks.

Key data

	Address range of the subnetwork	Possible number of networks	Possible number of Subscribers per network
Class A	1.XXX.XXX.XXX - 126.XXX.XXX.XXX	127 (2^7)	Ca. 16 Million (2^{24})
Class B	128.000.XXX.XXX - 191.255.XXX.XXX	Ca. 16 thousand (2^{14})	Ca 65 thousand (2^{16})
Class C	192.000.000.XXX - 223.255.255.XXX	Ca. 2 million (2^{21})	254 (2^8)

Each WAGO ETHERNET (programmable) fieldbus coupler or controller can be easily assigned an IP address via the implemented BootP protocol. For small internal networks we recommend selecting a network address from Class C.

Attention
Never set all bits to equal 0 or 1 in one byte (byte = 0 or 255). These are reserved for special functions and may not be allocated. Therefore, the address 10.0.10.10 may not be used due to the 0 in the second byte.

If a network is to be directly connected to the Internet, only registered, internationally unique IP addresses allocated by a central registration service may be used. These are available from Inter*NIC* (International Network Information Center).

Attention
Direct connection to the Internet should only be performed by an authorized network administrator and is therefore not described in this manual.

Subnets

To allow routing within large networks a convention was introduced in the specification *RFC 950*. Part of the Internet address, the subscriber ID is divided up again into a subnetwork number and the station number of the node. With the aid of the network number it is possible to branch into internal subnetworks within the partial network, but the entire network is physically connected together. The size and position of the subnetwork ID are not defined; however, the size is dependent upon the number of subnets to be addressed and the number of subscribers per subnet.

1		8	16	24	32
1	0	Net-ID	Subnet-ID	Host-ID	

Fig. 4-10: Class B address with Field for Subnet ID

Subnet mask

A subnet mask was introduced to encode the subnets in the Internet. This involves a bit mask, which is used to mask out or select specific bits of the IP address. The mask defines the subscriber ID bits used for subnet coding, which denote the ID of the subscriber. The entire IP address range theoretically lies between 0.0.0.0 and 255.255.255.255. Each 0 and 255 from the IP address range are reserved for the subnet mask.

The standard masks depending upon the respective network class are as follows:

Class A Subnet mask:

255	.0	.0	.0

Class B Subnet mask:

255	.255	.0	.0

Class C Subnet mask:

255	.255	.255	.0

Depending on the subnet division the subnet masks may, however, contain other values beyond 0 and 255, such as 255.255.255.128 or 255.255.255.248. Your network administrator allocates the subnet mask number to you. Together with the IP address, this number determines which network your PC and your node belongs to.

The recipient node, which is located on a subnet initially, calculates the correct network number from its own IP address and the subnet mask.
Only then does it check the node number and delivers the entire packet frame, if it corresponds.

Example of an IP address from a class B network:

IP address:	172.16.233.200	10101100 00010000 11101001 11001000
Subnet mask:	255.255.255.128	11111111 11111111 11111111 10000000
Net-ID:	172.16.00	10101100 00010000 00000000 00000000
Subnet-ID:	0.0.233.128	00000000 00000000 11101001 10000000
Host-ID:	0.0.0.72	00000000 00000000 00000000 01001000

Attention
Specify the network mask defined by the administrator in the same way as the IP address when installing the network protocol.

Gateway

The subnets of the Internet are normally connected via gateways. The function of these gateways is to forward packets to other networks or subnets.

This means that in addition to the IP address and network mask for each network card, it is necessary to specify the correct IP address of the standard gateway for a PC or fieldbus node connected to the Internet. You should also be able to obtain this IP address from your network administrator.
The IP function is limited to the local subnet if this address is not specified.

IP Packet

In addition to the data units to be transported, the IP data packets contain a range of address information and additional information in the packet header.

IP-Header	**IP-Data**

Fig. 4-11: IP Packet

The most important information in the IP header is the IP address of the transmitter and the receiver and the transport protocol used.

4.1.3.2.2.1 RAW IP

Raw IP manages without protocols such as PPP (point-to-point protocol). With RAW IP, the TCP/IP packets are directly exchanged without handshaking, thus enabling the connection to be established more quickly.

However, the connection must beforehand have been configured with a fixed IP address. The advantages of RAW IP are high data transfer rate and good stability.

4.1.3.2.2.2 IP Multicast

Multicast refers to a method of transmission from a point to a group, which is a point-to-multipoint transfer or multipoint connection. The advantage of multicast is that messages are simultaneously transferred to several users or closed user groups via one address.
IP multicasting at Internet level is realized with the help of the Internet Group Message Protocol IGMP; neighboring routers use this protocol to inform each other on membership to the group.
For distribution of multicast packets in the sub-network, IP assumes that the datalink layer supports multicasting. In the case of ETHERNET, you can provide a packet with a multicast address in order to send the packet to several recipients with a single send operation. Here, the common medium enables packets to be sent *simultaneously* to several recipients. The stations do not have to inform each other on who belongs to a specific multicast address – every station physically receives every packet. The resolution of IP address to ETHERNET address is solved by the use of algorithms, IP multicast addresses are embedded in ETHERNET multicast addresses.

4.1.3.2.3 TCP Protocol

As the layer above the Internet protocol, TCP (Transmission Control Protocol) guarantees the secure transport of data through the network.

TCP enables two subscribers to establish a connection for the duration of the data transmission. Communication takes place in full-duplex mode (i.e., transmission between two subscribers in both directions simultaneously).
TCP provides the transmitted message with a 16-bit checksum and each data packet with a sequence number.
The receiver checks that the packet has been correctly received on the basis of the checksum and then sets off the sequence number. The result is known as the acknowledgement number and is returned with the next self-sent packet as an acknowledgement.
This ensures that the lost TCP packets are detected and resent, if necessary, in the correct sequence.

TCP port numbers

TCP can, in addition to the IP address (network and subscriber address), respond to a specific application (service) on the addressed subscriber. For this the applications located on a subscriber, such as a web server, FTP server and others are addressed via different port numbers. Well-known applications are assigned fixed ports to which each application can refer when a connection is built up.

Examples:

Telnet	Port number: 23
HTTP	Port number: 80

A complete list of "standardized services" is contained in the *RFC 1700 (1994)* specifications.

TCP segment

The packet header of a TCP data packet is comprised of at least 20 bytes and contains, among others, the application port number of the transmitter and the receiver, the sequence number and the acknowledgement number.

The resulting TCP packet is used in the data unit area of an IP packet to create a TCP/IP packet.

4.1.3.2.4 UDP

The UDP protocol, like the TCP protocol, is responsible for the transport of data. Unlike the TCP protocol, UDP is not connection-orientated; meaning that there are no control mechanisms for the data exchange between transmitter and receiver. The advantage of this protocol is the efficiency of the transmitted data and the resulting higher processing speed.

4.1.3.2.5 ARP

ARP (Address Resolution Protocol).
This protocol combines the IP address with the physical MAC address of the respective ETHERNET card. It is always used when data transfer to an IP address takes place in the same logical network in which the sender is located.

4.1.3.3 Administration and Diagnosis Protocols

In addition to the communication protocols described above, various fieldbus specific application protocols and a view protocols for system administration and diagnosis can be implemented.

BootP
HTTP
DHCP
DNS
SNTP
FTP
SMTP

Additional Information
You can find a list of the exact available implemented protocols in the chapter "Technical Data" to the fieldbus coupler and/or controller.

4.1.3.3.1 BootP (Bootstrap Protocol)

The BootP protocol defines a request/response mechanism with which the MAC-ID of a fieldbus node can be assigned a fix IP address.
For this a network node is enabled to send requests into the network and call up the required network information, such as the IP address of a BootP server. The BootP server waits for BootP requests and generates the response from a configuration database.

The dynamic configuration of the IP address via a BootP server offers the user a flexible and simple design of his network. The WAGO BootP server allows any IP address to be easily assigned for the WAGO (programmable) fieldbus coupler or controller. You can download a free copy of the WAGO BootP server over the Internet at: http://www.wago.com.

Additional Information
The procedure for address allocation with the WAGO BootP Server is described in detail in the Chapter “Starting up a Fieldbus Node”.

The BOOTP Client allows for dynamic configuring of the network parameters:

Parameter	Meaning
IP address of the client	Network address of the (programmable) fieldbus coupler or controller
IP address of the router	If communication is to take place outside of the local network, the IP address of the routers (gateway) is indicated in this parameter.
Subnet mask	The Subnet mask makes the (programmable) fieldbus coupler or controller able to differentiate, which parts of the IP address determine the network and which the network station.
IP addresses of the DNS servers	Here the IP addresses can be entered by maximally 2 DNS servers.
Host name	Name of the host

When using the bootstrap protocol for configuring the node, the network parameters (IP address, etc...) are stored in the EEPROM.

Note
The network configuration is only stored in the EEPROM when the BootP protocol is used, although not if configuration is done via DHCP.

The BootP protocol is activated in the (programmable) fieldbus coupler or controller by default.

When the BootP protocol is activated, the (programmable) fieldbus coupler or controller expects a BootP server to be permanently present.
If, however, there is no BootP server available after a power-on reset, the network remains inactive.
To operate the (programmable) fieldbus coupler or controller with the IP configuration stored in the EEPROM, you must first deactivate the BootP protocol.
This is done via the web-based management system on the appropriate HTML page saved in the (programmable) fieldbus coupler or controller, which is accessed via the “Port” link.
If the BootP protocol is deactivated, the (programmable) fieldbus coupler or controller uses the parameters stored in the EEPROM at the next boot cycle.

If there is an error in the stored parameters, a blink code is output via the IO LED and configuration via BootP is automatically switched on.

4.1.3.3.2 HTTP (Hyper Text Transfer Protocol)

HTTP is a protocol used by WWW (World Wide Web) servers for the forwarding of hypermedia, texts, images, audio data, etc.Today, HTTP forms the basis of the Internet and is also based on requests and responses in the same way as the BootP protocol.

The HTTP server implemented in the (programmable) fieldbus coupler or controller is used for viewing the HTML pages saved in the coupler/controller. The HTML pages provide information about the coupler/controller (state, configuration), the network and the process image.
On some HTML pages, (programmable) fieldbus coupler or controller settings can also be defined and altered via the web-based management system (e.g. whether IP configuration of the coupler/controller is to be performed via the DHCP protocol, the BootP protocol or from the data stored in the EEPROM).
The HTTP server uses port **number 80**.

4.1.3.3.3 DHCP (Dynamic Host Configuration Protocol)

The coupler's/controller's built-in HTML pages provide an option for IP configuration from a DHCP server, a BootP server, or the data stored in its EEPROM by default.

Note
The network configuration via DHCP is not stored in the EEPROM, this only occurs when using the BootP protocol.

The DHCP client allows dynamic network configuration of the coupler/controller by setting the following parameters:

Parameter	Meaning
IP address of the client	Network address of the coupler/controller
IP address of the router	If communication is to take place outside of the local network, the IP address of the routers (gateway) is indicated in this parameter.
Subnet mask	The Subnet mask makes the coupler/controller able to differentiate, which parts of the IP address determine the network and which the network station.
IP addresses of the DNS servers	Here the IP addresses can be entered by maximally 2 DNS servers.
Lease time	Here the maximum duration can be defined, how long the coupler/controller keeps the assigned IP address. The maximum lease time is 24.8 days. This results from the internal resolution of timer.
Renewing time	The Renewing time indicates, starting from when the coupler/controller must worry about the renewal of the leasing time.
Rebinding time	The Rebinding time indicates, after which time the coupler/controller must have gotten its new address.

In the case of configuration of network parameters via the DHCP protocol, the coupler/controller automatically sends a request to a DHCP server after initialization. If there is no response, the request is sent again after 4 seconds, a further one after 8 seconds and again after 16 seconds. If all requests remain unanswered, a blink code is output via the “IO” LED. Transfer of the parameters from the EEPROM is not possible.

Where a lease time is used, the values for the renewing and rebinding time must also be specified. After the renewing time expires, the coupler/controller attempts to automatically renew the lease time for its IP address . If this continually fails up to the rebinding time, the coupler/controller attempts to obtain a new IP address. The time for the renewing should be about one half of the lease time. The rebinding time should be about $^7/_8$ of the lease time.

4.1.3.3.4 DNS (Domain Name Systems)

The DNS client enables conversion of logical Internet names such as www.wago.com into the appropriate decimal IP address represented with separator stops, via a DNS server. Reverse conversion is also possible.
The addresses of the DNS server are configured via DHCP or web-based management. Up to 2 DNS servers can be specified. The host identification can be achieved with two functions, an internal host table is not supported.

4.1.3.3.5 SNTP-Client (Simple Network Time Protocol)

The SNTP client is used for synchronization of the time of day between a time server (NTP and SNTP server Version 3 and 4 are supported) and the clock module integrated in the (programmable) fieldbus coupler or controller. The protocol is executed via a UDP port. Only unicast addressing is supported.

Configuration of the SNTP client

The configuration of the SNTP client is performed via the web-based management system under the “Clock” link. The following parameters must be set:

Parameter	Meaning
Address of the Time server	The address assignment can be made either over a IP address or a host name.
Time zone	The time zone relative to GMT (Greenwich Mean time). A range of -12 to +12 hours is acceptable.
Update Time	The update time indicates the interval in seconds, in which the synchronization with the time server is to take place.
Enable Time Client	It indicates whether the SNTP Client is to be activated or deactivated.

4.1.3.3.6 FTP-Server (File Transfer Protocol)

The file transfer protocol (FTP) enables files to be exchanged between different network stations regardless of operating system.

In the case of the ETHERNET coupler/controller, FTP is used to store and read the HTML pages created by the user, the IEC61131 program and the IEC61131 source code in the (programmable) fieldbus coupler or controller.

A total memory of 1.5 MB is available for the file system. The file system is mapped to RAM disk. To permanently store the data of the RAM disk, the information is additionally copied into the flash memory. The data is stored in the flash after the file has been closed. Due to the storage process, access times during write cycles are long.

Attention
Up to 1 million write cycles are possible for writing to the flash memory for the file system.

The following table shows the supported FTP commands for accesses to the file system:

Command	Function
USER	Identification of the user
PASS	User password
ACCT	Account for access to certain files
REIN	Server reset
QUIT	Terminates the connection
PORT	Addressing of the data link
PASV	Changes server in the listen mode
TYPE	Determines the kind of the representation for the transferred file
STRU	Determines the structure for the transferred file
MODE	Determines the kind of file transmission
RETR	Reads file from server
STOR	Saves file on server
APPE	Saves file on server (Append mode)
ALLO	Reservation of the necessary storage location for the file
RNFR	Renames file from (with RNTO)
RNTO	Renames file in (with RNFR)
ABOR	Stops current function
DELE	Deletes file
CWD	Changes directory
LIST	Gives the directory list

Command	Function
NLST	Gives the directory list
RMD	Deletes directory
PWD	Gives the actually path
MKD	Puts on a directory

The TFTP (Trivial File Transfer Protocol) is not supported by some of the couplers/controllers.

Additional Information
You can find a list of the exact available implemented protocols in the chapter "Technical Data" to the fieldbus coupler and/or controller.

4.1.3.3.7 SMTP (Simple Mail Transfer Protocol)

The Simple Mail Transfer Protocol (SMTP) enables sending of ASCII text messages to mail boxes on TCP/IP hosts in a network. It is therefore used for sending and receiving e-mails.

The e-mail to be sent is created with a suitable editor and placed in a mail out basket.

A send SMTP process polls the out-basket at regular intervals and therefore finds mail waiting to be sent. It then establishes a TCP/IP connection with the target host, to which the message is transmitted. The receive SMTP process on the target host accepts the TCP connection. The message is then transmitted and finally placed in an in-basket on the target system. SMTP expects the target system to be online, otherwise no TCP connection can be established. Since many desktop computers are switched off at the end of the day, it is impractical to send SMTP mail there. For that reason, in many networks special SMTP hosts are installed in many networks, which are permanently switched on to enable distribution of received mail to the desktop computers.

4.1.3.4 Application Protocols

If fieldbus specific application protocols are implemented, then the appropriate fieldbus specific communication is possible with the respective coupler/controller. Thus the user is able to have a simple access from the respective fieldbus on the fieldbus node. There are based on ETHERNET couplers/controllers available developed by WAGO, with the following possible application protocols:

MODBUS TCP (UDP)
EtherNet/IP
BACnet/IP
KNXnet/IP
PROFINET
Powerlink
SERCOS III

Additional Information
You can find a list of the exact available implemented protocols in the chapter "Technical Data" to the fieldbus coupler and/or controller.
If fieldbus specific application protocols are implemented, then these protocols are individual described in the following chapters.

4.2 PROFINET

4.2.1 Description

PROFINET is the innovative and open standard for industrial Ethernet (IEC 61158).

PROFINET enables a universal use from production automation to process automation. Devices can be integrated from the field levels to management levels.

PROFINET applies IT standards, supports safety applications and covers the complete range of drive engineering through its real-time feature.

PROFINET uses standard TCP/IP protocols for parameter setting, configuring and for diagnostics. This provides the main foundation for connecting to higher level systems (MES, ERP).

Real-Time (RT) is used for transmitting time-critical process data, which enables high performance data transfer as known with PROFIBUS.

Isochronous Real Time (IRT) is used to implement especially demanding tasks such as difficult motion control applications.

The investment protection of existing systems plays an important role for PROFINET and therefore the integration into existing field bus systems such as PROFIBUS, INTERBUS, etc. are supported right from the start.

PROFINET IO enables decentralized field devices to be connected to a central control system (IO controller). The familiar I/O view of PROFIBUS is maintained in doing so. The characteristics of the field devices are described by so-called GSDML files that are provided by the respective manufacturers.

PROFINET CBA (Component Based Automation) is used in distributed automation systems. It allows stand-alone operating part units of machines to be arranged to new individual units in a simple way that increases the reusability of these part units.

Standard network topologies such as star, tree, line and ring can be implemented using PROFINET. That way, the specific demands of Ethernet networks can be met in industrial environments.

A high standard of quality is ensured through inspections conforming to standards carried out within the PROFINET network and the certification of PROFINET devices.

Further information
The PROFIBUS & PROFINET user organization provides documents that deal with themes concerning PROFIBUS on their INTERNET page:
– Technical descriptions
– Guidelines

www.profibus.com

4.2.2 Cabling

The guidelines for Ethernet cabling apply to the cabling of the PROFINET network.

5 I/O Modules

5.1 Overview

For modular applications with the WAGO-I/O-SYSTEM 750, different types of I/O modules are available

- Digital Input Modules
- Digital Output Modules
- Analog Input Modules
- Analog Output Modules
- Special Modules
- System Modules

For detailed information on the I/O modules and the module variations, refer to the manuals for the I/O modules.

You will find these manuals on DVD ROM „AUTOMATION Tools and Docs“ (Item No.: 0888-0412) or at http://www.wago.com under Documentation.

Additional Information
Current information on the modular WAGO-I/O-SYSTEM is available in the Internet under: http://www.wago.com.

5.2 Structure of the PROFINET IO Process Data

Depending on the data type, the data bytes (D0 ... Dn) of the byte or word orientated I/O module are transferred via PROFINET IO in Motorola or Intel format according to the parameter settings of the device and individual signal channels.

Note
For the significance of input and output bits or bytes of the individual I/O modules please refer to the corresponding description of the I/O modules.

5.2.1 Digital Input Modules

5.2.1.1 2 DI Modules

75x-400, 75x-401, 75x-405, 75x-406, 75x-410, 75x-411, 75x-412, 75x-413, 75x-416, 75x-427, 75x-429, 75x-435, 75x-438

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes (not possible)	-	-
No	2	0

5.2.1.2 2 DI Modules with Diagnostics

75x-419, 75x-421, 75x-425
(1 bit diagnostics / channel)

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes	4	0
No	2	0

5.2.1.3 2 DI Modules with Diagnostics and Acknowledgement

75x-418
(1 bit diagnostics and acknowledge / channel)

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes (not possible)	4	2
No	2	2

5.2.1.4 4 DI Modules

75x-402, 75x-403, 75x-408, 75x-409, 75x-414, 75x-415, 75x-422, 75x-423, 75x-424, 75x-428, 75x-432, 75x-433, 75x-440, 75x-1420, 75x-1421, 75x-1422, 75x-1423

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes (not possible)	-	-
No	4	0

5.2.1.5 8 DI Modules

75x-430, 75x-431, 75x-434, 75x-436, 75x-437, 75x-1415, 75x-1416, 75x-1417, 75x-1418

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes (not possible)	-	-
No	8	0

5.2.1.6 16 DI Modules

750-1400, 750-1402, 750-1405, 750-1406, 750-1407, 750-1408

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes (not possible)	-	-
No	16	0

5.2.2 Digital Output Modules

5.2.2.1 2 DO Modules

75x-501, 75x-502, 75x-509, 75x-512, 75x-513, 75x-514, 75x-517, 75x-535

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes (not possible)	-	-
No	0	2

5.2.2.2 2 DO Modules with Diagnostics

75x-507, 75x-508, 75x-522, 750-523
(1 bit diagnostics / channel)

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes	2	2
No	0	2

75x-506
(2 bit diagnostics / channel)

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes	4	2
No	0	2

5.2.2.3 4 DO Modules

75x-504, 75x-516, 75x-519, 75x-531, 75x-540

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes (not possible)	-	-
No	0	4

5.2.2.4 4 DO Modules with Diagnostics

75x-532
(1 bit diagnostics / channel)

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes	4	4
No	0	4

5.2.2.5 8 DO Modules

75x-530, 75x-534, 75x-536, 75x-1515, 75x-1516

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes (not possible)	-	-
No	0	8

5.2.2.6 8 DO Modules with Diagnostics

75x-537
(1 bit diagnostics / channel)

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes	8	8
No	0	8

5.2.2.7 16 DO Modules

750-1500, 750-1501, 750-1504, 750-1505

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes (not possible)	-	-
No	0	16

5.2.2.8 8 DI/DO Modules

750-1502, 750-1506

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes (not possible)	-	-
No	8	8

5.2.3 Analog Input Modules

5.2.3.1 2 AI Modules

75x-452, 75x-454, 75x-456, 75x-461, 75x-462, 75x-465, 75x-466, 75x-467, 75x-469, 75x-470, 75x-472, 75x-473, 75x-474, 75x-475, 75x-476, 75x-477, 75x-478, 75x-479, 75x-480, 75x-481, 75x-483, 75x-485, 75x-487, 75x-491, 75x-492

Process Image Length in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	6	6
No	4	0

Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	D1	D1	D0	D0
	D0	D0	D1	D1
Channel 1	S1	C1	S1	C1
	D3	D3	D2	D2
	D2	D2	D3	D3
Mapping without access to the register structure				
	MOTOROLA		INTEL	
	Input	Output	Input	Output
Channel 0	D1	-	D0	-
	D0	-	D1	-
Channel 1	D3	-	D2	-
	D2	-	D3	-

5.2.3.2 3 AI Modules

75x-493

Process Image Length in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	12	12
No (not possible)	-	-

Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	-	-	-	-
	D1	D1	D0	D0
	D0	D0	D1	D1
Channel 1	S1	C1	S1	C1
	-	-	-	-
	D3	D3	D2	D2
	D2	D2	D3	D3
Channel 2	S2	C2	S2	C2
	-	-	-	-
	D5	D5	D4	D4
	D4	D4	D5	D5

5.2.3.3 4 AI Modules

75x-453, 75x-455, 75x-457, 75x-459, 75x-460, 75x-464, 75x-468

Process Image Length in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	12	12
No	8	0

Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	D1	D1	D0	D0
	D0	D0	D1	D1
Channel 1	S1	C1	S1	C1
	D3	D3	D2	D2
	D2	D2	D3	D3
Channel 2	S2	C2	S2	C2
	D5	D5	D4	D4
	D4	D4	D5	D5
Channel 3	S3	C3	S3	C3
	D7	D7	D6	D6
	D6	D6	D7	D7

Mapping without access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	D1	-	D0	-
	D0	-	D1	-
Channel 1	D3	-	D2	-
	D2	-	D3	-
Channel 2	D5	-	D4	-
	D4	-	D5	-
Channel 3	D7	-	D6	-
	D6	-	D7	-

5.2.4 Analog Output Modules

5.2.4.1 2 AO Modules

75x-550, 75x-552, 75x-554, 75x-556, 75x-560, 75x-562, 75x-563, 75x-585

<table>
<tr><th colspan="5">Process Image Length in [Byte]</th></tr>
<tr><td>Register communication using the PROFINET IO process image?</td><td colspan="2">Input</td><td colspan="2">Output</td></tr>
<tr><td>Yes</td><td colspan="2">6</td><td colspan="2">6</td></tr>
<tr><td>No</td><td colspan="2">0</td><td colspan="2">4</td></tr>
<tr><th colspan="5">Mapping with access to the register structure</th></tr>
<tr><td>Data format</td><td colspan="2">MOTOROLA</td><td colspan="2">INTEL</td></tr>
<tr><td>I/O range</td><td>Input</td><td>Output</td><td>Input</td><td>Output</td></tr>
<tr><td rowspan="3">Channel 0</td><td>S0</td><td>C0</td><td>S0</td><td>C0</td></tr>
<tr><td>D1</td><td>D1</td><td>D0</td><td>D0</td></tr>
<tr><td>D0</td><td>D0</td><td>D1</td><td>D1</td></tr>
<tr><td rowspan="3">Channel 1</td><td>S1</td><td>C1</td><td>S1</td><td>C1</td></tr>
<tr><td>D3</td><td>D3</td><td>D2</td><td>D2</td></tr>
<tr><td>D2</td><td>D2</td><td>D3</td><td>D3</td></tr>
<tr><th colspan="5">Mapping without access to the register structure</th></tr>
<tr><td>Data format</td><td colspan="2">MOTOROLA</td><td colspan="2">INTEL</td></tr>
<tr><td>I/O range</td><td>Input</td><td>Output</td><td>Input</td><td>Output</td></tr>
<tr><td rowspan="2">Channel 0</td><td>-</td><td>D1</td><td>-</td><td>D0</td></tr>
<tr><td>-</td><td>D0</td><td>-</td><td>D1</td></tr>
<tr><td rowspan="2">Channel 1</td><td>-</td><td>D3</td><td>-</td><td>D2</td></tr>
<tr><td>-</td><td>D2</td><td>-</td><td>D3</td></tr>
</table>

5.2.4.2 4 AO Modules

75x-553, 75x-555, 75x-557, 75x-559

Process Image Length in [Byte]				
Register communication using the PROFINET IO process image?	Input		Output	
Yes	12		12	
No	0		8	
Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	D1	D1	D0	D0
	D0	D0	D1	D1
Channel 1	S1	C1	S1	C1
	D3	D3	D2	D2
	D2	D2	D3	D3
Channel 2	S2	C2	S2	C2
	D5	D5	D4	D4
	D4	D4	D5	D5
Channel 3	S3	C3	S3	C3
	D7	D7	D6	D6
	D6	D6	D7	D7
Mapping without access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	-	D1	-	D0
	-	D0	-	D1
Channel 1	-	D3	-	D2
	-	D2	-	D3
Channel 2	-	D5	-	D4
	-	D4	-	D5
Channel 3	-	D7	-	D6
	-	D6	-	D7

5.2.5 Special Modules

5.2.5.1 Up/Down Counter

75x-404
(1 or 2 counter inputs)

Process Image Length in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	6	6
No (not possible)	-	-

Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	-	-	-	-
	D3	D3	D0	D0
	D2	D2	D1	D1
	D1	D1	D2	D2
	D0	D0	D3	D3

75x-638
(2 counter inputs)

Process Image Length in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	6	6
No (not possible)	-	-

Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	D1	D1	D0	D0
	D0	D0	D1	D1
Channel 1	S1	C1	S1	C1
	D3	D3	D2	D2
	D2	D2	D3	D3

5.2.5.2 2-Channel Pulse Width Output Module

75x-511

Process Image Length in [Byte]				
Register communication using the PROFINET IO process image?	Input		Output	
Yes	6		6	
No	0		4	
Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	D1	D1	D0	D0
	D0	D0	D1	D1
Channel 1	S1	C1	S1	C1
	D3	D3	D2	D2
	D2	D2	D3	D3
Mapping without access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	-	D1	-	D0
	-	D0	-	D1
Channel 1	-	D3	-	D2
	-	D2	-	D3

5.2.5.3 Pulse Train Output Module

75x-639

Process Image Length in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	4	4
No (not possible)	-	-

Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	-	-	-	-
	D1	D1	D0	D0
	D0	D0	D1	D1

5.2.5.4 SSI Transmitter Interface

75x-630

Process Image Length in [Byte]				
Register communication using the PROFINET IO process image?	Input		Output	
Yes	6		6	
No	4		0	
Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	-	-	-	-
	D3	D3	D0	D0
	D2	D2	D1	D1
	D1	D1	D2	D2
	D0	D0	D3	D3
Mapping without access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	D3	-	D0	-
	D2	-	D1	-
	D1	-	D2	-
	D0	-	D3	-

5.2.5.5 Incremental Encoder Interfaces

75x-631, 75x-634, 75x-637

Process Image in [Byte]				
Register communication using the PROFINET IO process image?	Input		Output	
Yes	6		6	
No (not possible)	-		-	
Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	D1	D1	D0	D0
	D0	D0	D1	D1
	S1*	C1*	S1*	C1*
	D3	D3	D2	D2
	D2	D2	D3	D3

* The 2nd CONTROL or STATUS byte only exists with 75x-637. The byte is reserved in all other I/O modules and has no content.

5.2.5.6 Digital Impulse Interface

75x-635

Process Image in [Byte]				
Register communication using the PROFINET IO process image?	Input		Output	
Yes	4		4	
No (not possible)	-		-	
Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	D0	D0	D0	D0
	D1	D1	D1	D1
	D2	D2	D2	D2

5.2.5.7 Serial Interfaces

75x-650, 75x-651, 75x-653

Process Image in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	6	6
No *3)	6	6

Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	D0	D0	D0	D0
	D1	D1	D1	D1
	D2	D2	D2	D2
	D3*1)	D3*1)	D3*1)	D3*1)
	D4*2)	D4*2)	D4*2)	D4*2)

If bytes D3 and D4 contain data depends on the data width:
*1) D3 contains data in 4- and 5-byte mode
*2) D4 contains data in 5-byte mode
*3) Bytes D3 and D4 are reserved in 3-byte mode (factory setting) and contain no information.

75x-652

Process Image in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	8, 24, 48	8, 24, 48
No (not possible)	-	-

Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	S1	C1	S1	C1
	D0	D0	D0	D0
	D1	D1	D1	D1
	…	…	…	...
8 Byte	D5	D5	D5	D5
	…	…	…	...
24 Byte	D21	D21	D21	D21
	…	…	…	...
48 Byte	D45	D45	D45	D45

5.2.5.8 Data Exchange Module

75x-654

Process Image Length in [Byte]				
Register communication using the PROFINET IO process image?	Input		Output	
Yes	6		6	
No	4		4	
Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	D0	D0	D0	D0
	D1	D1	D1	D1
	D2	D2	D2	D2
	D3	D3	D3	D3
	D4	D4	D4	D4
Mapping without access to register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	D0	D0	D1	D1
	D1	D1	D0	D0
	D2	D2	D3	D3
	D3	D3	D2	D2

5.2.5.9 KNX/EIB/TP1 Module

75x-646

Process Image Length in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	24	24
No (not possible)	-	-

Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	I/O range	Input
Channel 0	S0	C0	S0	C0
	D0	D0	D0	D0
	D1	D1	D1	D1
	D2	D2	D2	D2
	D3	D3	D3	D3
	D4	D4	D4	D4
	…	…	…	...
	D22	D22	D22	D22

5.2.5.10 DALI/DSI Master Module

75x-641

Process Image in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	6	6
No (not possible)	-	-

Mapping with access to the register structure				
Data format	MOTOROLA / INTEL			
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	D0	D0	D0	D0
	D1	D1	D1	D1
	D2	D2	D2	D2
	D3	D3	D3	D3
	D4	D4	D4	D4

5.2.5.11 AS-Interface Master

75x-655

Process Image in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	12, 20, 24, 32, 40, 48	12, 20, 24, 32, 40, 48
No (not possible)	-	-

Mapping with access to the register structure				
Data format	MOTOROLA / INTEL		Data format	
I/O range	Input	I/O range	Input	I/O range
Channel 0	S0	C0	S0	C0
	-	-	-	-
	MBX0 / D0	MBX0 / D0	MBX0 / D0	MBX0 / D0
	MBX1 / D1	MBX1 / D1	MBX1 / D1	MBX1 / D1
	...	...	...	...
12 Byte	MBX9 / D9	MBX9 / D9	MBX9 / D9	MBX9 / D9
	…	…	…	...
20 Byte	MBX17 / D17	MBX17 / D17	MBX17 / D17	MBX17 / D17
	…	…	…	...
24 Byte	D21	D21	D21	D21
	…	…	…	...
32 Byte	D29	D29	D29	D29
	…	…	…	...
40 Byte	D37	D37	D37	D37
	…	…	…	...
48 Byte	D45	D45	D45	D45

5.2.5.12 Radio Receiver Module

750-642

<table>
<tr><th colspan="5">Process Image in [Byte]</th></tr>
<tr><td colspan="2">Register communication using the PROFINET IO process image?</td><td colspan="2">Input</td><td>Output</td></tr>
<tr><td colspan="2">Yes</td><td colspan="2">4</td><td>4</td></tr>
<tr><td colspan="2">No (not possible)</td><td colspan="2">-</td><td>-</td></tr>
<tr><th colspan="5">Mapping with access to the register structure</th></tr>
<tr><td>Data format</td><td colspan="4">MOTOROLA / INTEL</td></tr>
<tr><td>I/O range</td><td>Input</td><td>Output</td><td>Input</td><td>Output</td></tr>
<tr><td rowspan="4">Channel 0</td><td>S0</td><td>C0</td><td>S0</td><td>C0</td></tr>
<tr><td>D0</td><td>D0</td><td>D0</td><td>D0</td></tr>
<tr><td>D1</td><td>D1</td><td>D1</td><td>D1</td></tr>
<tr><td>D2</td><td>D2</td><td>D2</td><td>D2</td></tr>
</table>

5.2.5.13 *Bluetooth*® / RF-Transceiver

75x-644

Process Image in [Byte]				
Register communication using the PROFINET IO process image?		Input		Output
Yes		12, 24, 48		12, 24, 48
No (not possible)		-		-
Mapping with access to the register structure				
Data format	MOTOROLA / INTEL		Data format	
I/O range	Input	I/O range	Input	I/O range
Channel 0	S0	C0	S0	C0
	-	-	-	-
	MBX0 / D0	MBX0 / D0	MBX0 / D0	MBX0 / D0
	MBX1 / D1	MBX1 / D1	MBX1 / D1	MBX1 / D1
	...	...	...	...
12 Byte	D9	D9	D9	D9
	…	…	…	...
24 Byte	D21	D21	D21	D21
	…	…	…	...
48 Byte	D45	D45	D45	D45

5.2.5.14 MP-Bus Master Module

75x-643

Process Image in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	8	8
No (not possible)	-	-

Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	S1	C1	S1	C1
	D0	D0	D0	D0
	D1	D1	D1	D1
	D2	D2	D2	D2
	D3	D3	D3	D3
	D4	D4	D4	D4
	D5	D5	D5	D5

5.2.5.15 2-Channel Vibration Velocity / Bearing Condition Monitoring VIB I/O

75x-645

Process Image in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes	12	12
No (not possible)	-	-

Mapping with access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	D1	D1	D0	D0
	D0	D0	D1	D1
Channel 1	S1	C1	S1	C1
	D3	D3	D2	D2
	D2	D2	D3	D3
Channel 0	S2	C2	S2	C2
	D5	D5	D4	D4
	D4	D4	D5	D5
Channel 1	S3	C3	S3	C3
	D7	D7	D6	D6
	D6	D6	D7	D7

5.2.5.16 Safety Modules PROFIsafe

753-662/000-002, 753-667/000-002, 75x-661/000-003, 75x-662/000-003, 75x-666/000-003, 75x-667/000-003

Process Image in [Byte]		
Register communication using the PROFINET IO process image?	Input	Output
Yes (not possible)	-	-
No	5	5

Mapping without access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0…3 (7[*1)])	D0	D0	D0	D0
	F_S	F_C	F_S	F_C
	F_D_CRC0	F_H_CRC0	F_H_CRC0	F_H_CRC0
	F_D_CRC1	F_H_CRC1	F_H_CRC1	F_H_CRC1
	F_D_CRC2	F_H_CRC2	F_H_CRC2	F_H_CRC2

[*1)] for 753-662/000-002 and 75x-662/000-003

5.2.5.17 RTC Module

75x-640

<table>
<tr><th colspan="5">Process Image in [Byte]</th></tr>
<tr><td>Register communication using the PROFINET IO process image?</td><td colspan="2">Input</td><td colspan="2">Output</td></tr>
<tr><td>Yes</td><td colspan="2">6</td><td colspan="2">6</td></tr>
<tr><td>No (not possible)</td><td colspan="2">-</td><td colspan="2">-</td></tr>
<tr><th colspan="5">Mapping without access to the register structure</th></tr>
<tr><td>Data format</td><td colspan="2">MOTOROLA</td><td colspan="2">INTEL</td></tr>
<tr><td>I/O range</td><td>Input</td><td>Output</td><td>Input</td><td>Output</td></tr>
<tr><td rowspan="6">Channel 0</td><td>S0</td><td>C0</td><td>S0</td><td>C0</td></tr>
<tr><td>D0</td><td>D0</td><td>D0</td><td>D0</td></tr>
<tr><td>D1</td><td>D1</td><td>D1</td><td>D1</td></tr>
<tr><td>D2</td><td>D2</td><td>D2</td><td>D2</td></tr>
<tr><td>D3</td><td>D3</td><td>D3</td><td>D3</td></tr>
<tr><td>D4</td><td>D4</td><td>D4</td><td>D4</td></tr>
</table>

5.2.5.18 Stepper Controller

75x-670, 75x-671, 750-672, 750-673

Process Image in [Byte]				
Register communication using the PROFINET IO process image?		Input		Output
Yes		12		12
No (not possible)		-		-
Mapping without access to the register structure				
Data format	MOTOROLA		INTEL	
I/O range	Input	Output	Input	Output
Channel 0	S0	C0	S0	C0
	-	-	-	-
	MBX0 / D0	MBX0 / D0	MBX0 / D0	MBX0 / D0
	MBX1 / D1	MBX1 / D1	MBX1 / D1	MBX1 / D1
	MBX2 / D2	MBX2 / D2	MBX2 / D2	MBX2 / D2
	MBX3 / D3	MBX3 / D3	MBX3 / D3	MBX3 / D3
	MBX4 / D4	MBX4 / D4	MBX4 / D4	MBX4 / D4
	- / D5	- / D5	- / D5	- / D5
	S3	C3	S3	C3
	S2	C2	S2	C2
	S1	C1	S1	C1

5.2.5.19 DC-Drive Controller

75x-636

<table>
<tr><th colspan="5">Process Image in [Byte]</th></tr>
<tr><td>Register communication using the PROFINET IO process image?</td><td colspan="2">Input</td><td colspan="2">Output</td></tr>
<tr><td>Yes</td><td colspan="2">6</td><td colspan="2">6</td></tr>
<tr><td>No (not possible)</td><td colspan="2">-</td><td colspan="2">-</td></tr>
<tr><th colspan="5">Mapping without access to the register structure</th></tr>
<tr><td>Data format</td><td colspan="2">MOTOROLA</td><td colspan="2">INTEL</td></tr>
<tr><td>I/O range</td><td>Input</td><td>Output</td><td>Input</td><td>Output</td></tr>
<tr><td rowspan="6">Channel 0</td><td>S0</td><td>C0</td><td>S0</td><td>C0</td></tr>
<tr><td>D0</td><td>D0</td><td>D0</td><td>D0</td></tr>
<tr><td>D1</td><td>D1</td><td>D1</td><td>D1</td></tr>
<tr><td>D2</td><td>D2</td><td>D2</td><td>D2</td></tr>
<tr><td>D3</td><td>D3</td><td>D3</td><td>D3</td></tr>
<tr><td>D4</td><td>D4</td><td>D4</td><td>D4</td></tr>
</table>

5.2.6 System Modules

5.2.6.1 Power Supply Modules

750-606, 750-610, 750-611
(2 bit diagnostics)

Process Image Length in [Bit]		
Diagnostic information in the PROFIBUS IO process image	Input	Output
Yes	2	0
No	0	0

5.3 Configuration and Parameter Settings of the I/O Modules

5.3.1 Digital I/O Modules

5.3.1.1 2-Channel Digital Input Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
2DI(+6 BIT I)	**DI_8**	75x-400, 75x-401, 75x-405, 75x-406, 75x-410, 75x-411, 75x-412, 75x-413, 75x-416, 75x-427, 75x-429, 75x-435, 75x-438	Unsigned8 Bitfield	1	-
2DI(+14 BIT I)	**DI_16**		Unsigned16 Bitfield		
2DI(+30 BIT I)	**DI_32**		Unsigned32 Bitfield		
*** 2DI(-2 BIT I)**	**DI_0**	75x-400*, 75x-401*, 75x-405*, 75x-406*, 75x-410*, 75x-411*, 75x-412*, 75x-413*, 75x-416*, 75x-427*, 75x-429*, 75x-435*, 75x-438*	-	-	-

PNIO Modul type	Inputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
2DI(+6 BIT I) **2DI(+14 BIT I)** **2DI(+30 BIT I)**	2							I1	I0	8, 16 or 32 bits are allocated within the input process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 and 2^1 are assigned to the input states of the physically connected I/O module. The bits marked green are made available for the input and/or diagnostic states of the following module slots. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
*** 2DI(-2 BIT I)**	2					I1	I0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input process image by configuration modules without a star to be assigned to the signal states of the physically connected I/O module. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
				I1	I0					
		...								
		I1	I0							

General module/channel parameters		
Parameter	**Value**	**Significance**

5.3.1.2 2-Channel Digital Input Modules with 1 Bit Diagnostics per Channel

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
2DI(+6 BIT I)	DI_8	75x-419, 75x-421, 75x-425	Unsigned8 Bitfield	1	-
2DI(+4 BIT I), DIA in I-PI	DI_DIA_8				
2DI(+14 BIT I)	DI_16		Unsigned16 Bitfield		
2DI(+12 BIT I), DIA in I-PI	DI_DIA_16				
2DI(+30 BIT I)	DI_32		Unsigned32 Bitfield		
2DI(+28 BIT I), DIA in I-PI	DI_DIA_32				
* 2DI(-2 BIT I)	DI_0	75x-419*, 75x-421*, 75x-425*	-	-	-
* 2DI(-4 BIT I), DIA in I-PI	DI_DIA_0				

PNIO Module type	Inputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
2DI(+6 BIT I) 2DI(+14 BIT I) 2DI(+30 BIT I)	2							I1	I0	8, 16 or 32 bits are allocated within the input process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 and 2^1 are assigned to the input states of the physically connected I/O module. Furthermore, the bits 2^2 and 2^3 contain the diagnostic state of each signal channel in case of of **2DI**, **DIA in I-PI**. The bits marked green are made available for the input and/or diagnostic information of the following module slots. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
2DI(+4 BIT I), DIA in I-PI 2DI(+12 BIT I), DIA in I-PI 2DI(+28 BIT I), DIA in I-PI	4					D1	D0	I1	I0	
* 2DI(-2 BIT I)	2					I1	I0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input process image by configuration modules without a star to be assigned to the signal states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
				I1	I0					
		...								
		I1	I0							

PNIO Module type	Inputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
*** 2DI(-4 BIT I), DIA in I-PI**	4			D1	D0	I1	I0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input process image by configuration modules without a star to be assigned to the signal and diagnostic states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		D1	D0	I1	I0					
		...								
		D1	D0	I1	I0					

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel x (x = 0, 1)		With external faults, channel diagnostics and the respective alarms are
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
	*) Default settings	

5.3.1.3 2-Channel Digital Input Modules with 1 Bit Diagnostics and Acknowledgement per Channel

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
2DI(+6 BIT I), 2ACK(+6 BIT O)	**DIO_8**	75x-418	Unsigned8 Bitfield	1	1
2DI(+4 BIT I), 2ACK(+6 BIT O), DIA in I-PI	**DIO_DIA_8**				
2DI(+14 BIT I), 2ACK(+14 BIT O)	**DIO_16**		Unsigned16 Bitfield		
2DI(+12 BIT I), 2ACK(+14 BIT O), DIA in I-PI	**DIO_DIA_16**				
2DI(+30 BIT I), 2ACK(+30 BIT O)	**DIO_32**		Unsigned32 Bitfield		
2DI(+28 BIT I), 2ACK(+30 BIT O), DIA in I-PI	**DIO_DIA_32**				
*** 2DI(-2 BIT I), 2ACK(-2 BIT O)**	**DIO_0**	75x-418*	-	-	-
*** 2DI(-4 BIT I), 2ACK(-2 BIT O), DIA in I-PI**	**DIO_DIA_0**				

PNIO Module type	In-/Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
2DI(+6 BIT I), 2ACK(+6 BIT O) **2DI(+14 BIT I), 2ACK(+14 BIT O)** **2DI(+30 BIT I), 2ACK(+30 BIT O)**	2							A1	A0	8, 16 or 32 bits are allocated within the input and output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 and 2^1 in the input area are assigned to the input states of the physically connected I/O module. The bits 2^2 to 2^7, 2^{15} or 2^{31} in the input area marked green are made available for the input and / or diagnostic states of the following module slots. The bits 2^0 and 2^1 in the output area are assigned to the acknowledgement states of the physically connected I/O module. The bits 2^2 to 2^7, 2^{15} or 2^{31} in the output area marked green are made available for the output and / or acknowledgement states of the following module slots. Two byte process data qualifiers (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
	2							I1	I0	
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								

PNIO Module type	Length [Bit]	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	Note
2DI(+4 BIT I), 2ACK(+6 BIT O), DIA in I-PI **2DI(+12 BIT I), 2ACK(+14 BIT O), DIA in I-PI** **2DI(+28 BIT I), 2ACK(+30 BIT O), DIA in I-PI**	2							A1	A0	8, 16 or 32 bits are allocated in the input and output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 and 2^1 in the input area are assigned to the input states of the physically connected I/O module, the bits 2^2 and 2^3 carry the diagnostic states of the each input channel. The bits 2^4 to 2^7 ,2^{15} or 2^{31} marked green are made available for the input and / or diagnostic states of the following module slots. The bits 2^0 and 2^1 in the output area are used to confirm diagnostic states of the input channels. The bits 2^2 to 2^7, 2^{15} or 2^{31} marked green are made available for the output and / or acknowledgement states of the following module slots. Two byte process data qualifiers (IOPS, IOCS) are managed in the direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
	4					D1	D0	I1	I0	
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								

PNIO Module type	In-/Outputs Length [Bit]	Bit allocation 2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	Note
*** 2DI(-2 BIT I), 2ACK(-2 BIT O)**	2					I1	I0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input and output process image by configuration modules without a star to be assigned to the input and acknowledgement states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
				I1	I0					
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
		...								
		I1	I0							
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
	2					A1	A0			
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
				A1	A0					
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
		...								
		A1	A0							
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								

PNIO Module type	In-/Outputs										
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
*** 2DI(-4 BIT I), 2ACK(-2 BIT O), DIA in I-PI Output see * 2DI(-2 BIT I), 2ACK(-2 BIT O), DIA in I-PI**	4			D1	D0	I1	I0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input and output process image by configuration modules without a star to be assigned to the input, diagnostic and acknowledgement states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
		D1	D0	I1	I0					
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
		...								
		D1	D0	I1	I0					
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel x (x = 0, 1)		With external faults, channel diagnostics and the respective alarms are
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
	*) Default settings	

5.3.1.4 4-Channel Digital Input Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
4DI(+4 BIT I)	**DI_8**	75x-402, 75x-403, 75x-408, 75x-409, 75x-414, 75x-415, 75x-422, 75x-423, 75x-424, 75x-428, 75x-432, 75x-433, 75x-440, 75x-1420, 75x-1421, 75x-1422, 75x-1423	Unsigned8 Bitfield	1	-
4DI(+12 BIT I)	**DI_16**		Unsigned16 Bitfield		
4DI(+28 BIT I)	**DI_32**		Unsigned32 Bitfield		
*** 4DI(-4 BIT I)**	**DI_0**	75x-402*, 75x-403*, 75x-408*, 75x-409*, 75x-414*, 75x-415*, 75x-422*, 75x-423*, 75x-424*, 75x-428*, 75x-432*, 75x-433*, 75x-440*, 75x-1420*, 75x-1421*, 75x-1422*, 75x-1423*	-	-	-

PNIO Module Type	Inputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
4DI(+4 BIT I) **4DI(+12 BIT I)** **4DI(+28 BIT I)**	4					I3	I2	I1	I0	8, 16 or 32 bits are allocated within the input process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 to 2^3 are assigned to the input states of the physically connected I/O module. The bits marked green are made available for the input and/or diagnostic states of the following module slots. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
*** 4DI(-4 BIT I)**	4			I3	I2	I1	I0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input process image by configuration modules without a star to be assigned to the signal states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		I3	I2	I1	I0					
		...								
		I3	I2	I1	I0					

General module/channel parameters		
Parameter	**Value**	**Significance**

5.3.1.5 8-Channel Digital Input Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
8DI	**DI_8**	75x-430, 75x-431, 75x-434, 75x-436, 75x-437, 75x-1415, 75x-1416, 75x-1417, 75x-1418	Unsigned8 Bitfield	1	-
8DI(+8 BIT I)	**DI_16**		Unsigned16 Bitfield		
8DI(+24 BIT I)	**DI_32**		Unsigned32 Bitfield		
*** 8DI(-8 BIT I)**	**DI_0**	75x-430*, 75x-431*, 75x-434*, 75x-436*, 75x-437*, 75x-1415*, 75x-1416*, 75x-1417*, 75x-1418*	-	-	-

PNIO Module Type	Inputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
8DI **8DI(+8 BIT I)** **8DI(+24 BIT I)**	8	I7	I6	I5	I4	I3	I2	I1	I0	8, 16 or 32 bits are allocated within the input process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 to 2^7 are assigned to the input states of the physically connected I/O module. The bits marked green are made available for the input and/or diagnostic states of the following module slots. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
*** 8DI(-8 BIT I)**	8	I5	I4	I3	I2	I1	I0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input process image by configuration modules without a star to be assigned to the signal states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
								I7	I6	
		I3	I2	I1	I0					
						I7	I6	I5	I4	
		...								
		I7	I6	I5	I4	I3	I2	I1	I0	

General module/channel parameters		
Parameter	**Value**	**Significance**

5.3.1.6 16-Channel Digital Input Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
16DI	**DI_16**	750-1400, 750-1402, 75x-1405 75x-1406, 75x-1407, 75x-1408	Unsigned16 Bitfield	1	-
16DI(+16 BIT I)	**DI_32**		Unsigned32 Bitfield		
*** 16DI(-16 BIT I)**	**DI_0**	750-1400*, 750-1402*, 75x-1405* 75x-1406*, 75x-1407*, 75x-1408*	-	-	-

PNIO Module Type	Inputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
16DI **16DI(+16 BIT I)**	16	I7	I6	I5	I4	I3	I2	I1	I0	16 or 32 bits are allocated within the input process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 to 2^{15} are assigned to the input states of the physically connected I/O module. The bits marked green are made available for the input and/or diagnostic states of the following module slots. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
		I15	I14	I13	I12	I11	I10	I9	I8	
***16DI(-16 BIT I)**	16	I5	I4	I3	I2	I1	I0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input process image by configuration modules without a star to be assigned to the signal states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		I13	I12	I11	I10	I9	I8	I7	I6	
								I15	I14	
		I3	I2	I1	I0					
		I11	I10	I9	I8	I7	I6	I5	I4	
						I15	I14	I13	I12	
		...								
		I7	I6	I5	I4	I3	I2	I1	I0	
		I15	I14	I13	I12	I11	I10	I9	I8	

General module/channel parameters		
Parameter	**Value**	**Significance**

5.3.2 Digital Output Modules

5.3.2.1 2-Channel Digital Output Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
2DO(+6 BIT O)	**DO_8**	75x-501, 75x-502, 75x-509, 75x-512, 75x-513, 75x-514, 75x-517, 75x-535	Unsigned8 Bitfield	-	1
2DO(+14 BIT O)	**DO_16**		Unsigned16 Bitfield		
2DO(+30 BIT O)	**DO_32**		Unsigned32 Bitfield		
*** 2DO(-2 BIT O)**	**DO_0**	75x-501*, 75x-502*, 75x-509*, 75x-512*, 75x-513*, 75x-514*, 75x-517*, 75x-535*	-	-	-

PNIO Module type	Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
2DO(+6 BIT O) **2DO(+14 BIT O)** **2DO(+30 BIT O)**	2							O1	O0	8, 16 or 32 bits are allocated within the output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 and 2^1 are assigned to the output states of the physically connected I/O module. The bits marked green are made available for the output and/or acknowledgement states of the following module slots. One byte process data qualifier (IOCS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
***2DO(-2 BIT O)**	2					O1	O0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the output process image by configuration modules without a star to be assigned to the signal states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
				O1	O0					
		...								
		O1	O0							

General module/channel parameters		
Parameter	**Value**	**Significance**
Substitute value behavior of outputs		Applies when the IO controller does not supply valid output data for the module or the group of modules
	according to device settings*)	• the substitute strategy on the side of the station proxy applies (IO device).
	Outputs are set to zero	• all outputs are immediately reset
	Outputs are set to last valid states	• all outputs maintain the last valid value
	Outputs are set to substitute states	• all outputs switch to their configured substitute value
Output substitute state		When configuring the substitute value behavior on the side of the I/O module, these values are transmitted to the binary signal channel with invalid output states of the IO controller.
Channel x (x = 0, 1)	0*)	
	1	
	*) Default settings	

5.3.2.2 2 (1)-Channel Digital Output Modules with 1 Bit Diagnostic per Channel

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
2DO(+6 BIT O)	**DO_8**	75x-507, 75x-508, 75x-522, 750-523 (1 DO)	Unsigned8 Bitfield	-	1
2DO(+6 BIT I/O), DIA in I-PI	**DO_DIA_8**			1	1
2DO(+14 BIT O)	**DO_16**		Unsigned16 Bitfield	-	1
2DO(+12 BIT I/O), DIA in I-PI	**DO_DIA_16**			1	1
2DO(+30 BIT O)	**DO_32**		Unsigned32 Bitfield	-	1
2DO(+28 BIT I/O), DIA in I-PI	**DO_DIA_32**			1	1
*** 2DO(-2 BIT O)**	**DO_0**	75x-507*, 75x-508*, 75x-522*, 75x-523* (1 DO)	-	-	-
*** 2DO(-2 BIT I/O), DIA in I-PI**	**DO_DIA_0**				

PNIO Module type	In-/Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
2DO(+6 BIT O) **2DO(+14 BIT O)** **2DO(+30 BIT O)**	2							O1	O0	8, 16 or 32 bits are allocated within the output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 and 2^1 are assigned to the output states of the physically connected I/O module. The bits 2^2 to 2^7, 2^{15} or 2^{31} marked green are made available for the output and/or acknowledgement states of the following module slots. One byte process data qualifier (IOCS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
2DO(+6 BIT I/O), DIA in I-PI **2DO(+14 BIT I/O), DIA in I-PI** **2DO(+30 BIT I/O), DIA in I-PI**	2							O1	O0	8, 16 or 32 bits are allocated within the input and output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 and 2^1 in the output area are assigned to the output states of the physically connected I/O module. The bits 2^2 to 2^7, 2^{15} or 2^{31} in the output area marked green are made available for the output and / or acknowledgement states of the following module slots. The bits 2^0 and 2^1 in the input area are assigned to the diagnostic states of the physically connected I/O module. The bits 2^2 to 2^7, 2^{15} or 2^{31} in the input area marked green are made available for the input and / or diagnostic states of the following module slots. Two byte process data qualifiers (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
	2							D1	D0	
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								

PNIO Module type	In-/Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
* 2DO(-2 BIT O)	2					O1	O0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the output process image by configuration modules without a star to be assigned to the signal states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
				O1	O0					
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
		. . .								
		O1	O0							
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
* 2DO(-2 BIT I/O), DIA in I-PI Output see * 2DO(-2 BIT O)	2					D1	D0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input and output process image by configuration modules without a star to be assigned to the output and diagnostic states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
				D1	D0					
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
		. . .								
		D1	D0							
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel x (x = 0, 1)		With external faults, channel diagnostic and the respective alarms are
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
Substitute value behavior of outputs		Applies when the IO controller does not supply valid output data for the module or the group of modules
	according to device settings*)	• the substitute strategy on the side of the station proxy applies (IO device).
	Outputs are set to zero	• all outputs are immediately reset
	Outputs are set to last valid states	• all outputs maintain the last valid value
	Outputs are set to substitute states	• all outputs switch to their configured substitute value
Output substitute state		When configuring the substitute value behavior on the side of the I/O module, these values are transmitted to the binary signal channel with invalid output states of the IO controller.
Channel x (x = 0, 1)	0*)	
	1	
	*) Default settings	

5.3.2.3 2 (1)-Channel Digital Output Modules with 2 Bit Diagnostics per Channel

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
2DO(+6 BIT O)	DO_8	75x-506	Unsigned8 Bitfield	-	1
2DO(+6 BIT O, +4 BIT I), DIA in I-PI	DO_DIA_8			1	1
2DO(+14 BIT O)	DO_16		Unsigned16 Bitfield	-	1
2DO(+14 BIT O, +12 BIT I), DIA in I-PI	DO_DIA_16			1	1
2DO(+30 BIT O)	DO_32		Unsigned32 Bitfield	-	1
2DO(+30 BIT O, +28 BIT I), DIA in I-PI	DO_DIA_32			1	1
* 2DO(-2 BIT O)	DO_0	75x-506*	-	-	-
* 2DO(-2 BIT O, -4 BIT I), DIA in I-PI	DO_DIA_0				

PNIO Module type	In-/Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
2DO(+6 BIT O) 2DO(+14 BIT O) 2DO(+30 BIT O)	2							O1	O0	8, 16 or 32 bits are allocated within the output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 and 2^1 are assigned to the output states of the physically connected I/O module. The bits 2^2 to 2^7, 2^{15} or 2^{31} marked green are made available for the output and/or acknowledgement states of the following module slots. One byte process data qualifier (IOCS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
2DO(+6 BIT O, +4 BIT I), DIA in I-PI 2DO(+14 BIT O, +12 BIT I), DIA in I-PI 2DO(+30 BIT O, +28 BIT I), DIA in I-PI	2							O1	O0	8, 16 or 32 bits are allocated within the input and output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 and 2^1 in the output area are assigned to the output states of the physically connected I/O module. The bits 2^2 to 2^7 , 2^{15} or 2^{31} in the output area marked green are made available for the output and / or acknowledgement states of the following module slots. The bits 2^0 to 2^3 in the input area are assigned to the diagnostic states of the physically connected I/O module. The bits 2^4 to 2^7 , 2^{15} or 2^{31} in the input area marked green are made available for the input and / or diagnostic states of the following module slots. Two byte process data qualifiers (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
	4					D11	D10	D01	D00	
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								

PNIO Module type	In-/Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
*** 2DO(-2 BIT O)**	2					O1	O0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the output process image by configuration modules without a star to be assigned to the output states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
				O1	O0					
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
		...								
		O1	O0							
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
*** 2DO(-2 BIT O, -4 BIT I), DIA in I-PI** **Output see * 2DO(-2 BIT O)**	4			D11	D10	D01	D00			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input and output process image by configuration modules without a star to be assigned to the output and diagnostic states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								
		D11	D10	D01	D00					
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								
		...								
		D11	D10	D01	D00					
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel x (x = 0, 1)		With external faults, channel diagnostics and the respective alarms are
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
Substitute value behavior of outputs		Applies when the IO controller does not supply valid output data for the module or the group of modules
	according to device settings*)	• the substitute strategy on the side of the station proxy applies (IO device).
	Outputs are set to zero	• all outputs are immediately reset
	Outputs are set to last valid states	• all outputs maintain the last valid value
	Outputs are set to substitute states	• all outputs switch to their configured substitute value
Output substitute state		When configuring the substitute value behavior on the side of the I/O module, these values are transmitted to the binary signal channel with invalid output states of the IO controller.
Channel x (x = 0, 1)	0*)	
	1	
	*) Default settings	

5.3.2.4 4-Channel Digital Output Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
4DO(+4 BIT O)	DO_8	75x-504, 75x-516, 75x-519 75x-531, 75x-540	Unsigned8 Bitfield	-	1
4DO(+12 BIT O)	DO_16		Unsigned16 Bitfield		
4DO(+28 BIT O)	DO_32		Unsigned32 Bitfield		
* 4DO(-4 BIT O)	DO_0	75x-504*, 75x-516*, 75x-519* 75x-531*, 75x-540*	-	-	-

PNIO Module type	Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
4DO(+4 BIT O) 4DO(+12 BIT O) 4DO(+28 BIT O)	4					O3	O2	O1	O0	8, 16 or 32 bits are allocated within the output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 to 2^3 are assigned to the output states of the physically connected I/O module. The bits 2^4 to 2^7, 2^{15} or 2^{31} marked green are made available for the output and/or acknowledgement states of the following module slots. One byte process data qualifier (IOCS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
* 4DO(-4 BIT O)	4			O3	O2	O1	O0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the output process image by configuration modules without a star to be assigned to the signal states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		O3	O2	O1	O0					
		...								
		O3	O2	O1	O0					

General module/channel parameters		
Parameter	**Value**	**Significance**
Substitute value behavior of outputs		Applies when the IO controller does not supply valid output data for the module or the group of modules
	according to device settings*)	• the substitute strategy on the side of the station proxy applies (IO device).
	Outputs are set to zero	• all outputs are immediately reset
	Outputs are set to last valid states	• all outputs maintain the last valid value
	Outputs are set to substitute states	• all outputs switch to their configured substitute value
Output substitute state		When configuring the substitute value behavior on the side of the I/O module, these values are transmitted to the binary signal channel with invalid output states of the IO controller.
Channel x (x = 0 ... 3)	0*)	
	1	
	*) Default settings	

5.3.2.5 4-Channel Digital Output Modules with 1 Bit Diagnostics per Channel

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
4DO(+4 BIT O)	DO_8	75x-532	Unsigned8 Bitfield	-	1
4DO(+4 BIT I/O), DIA in I-PI	DO_DIA_8			1	1
4DO(+12 BIT O)	DO_16		Unsigned16 Bitfield	-	1
4DO(+12 BIT I/O), DIA in I-PI	DO_DIA_16			1	1
4DO(+28 BIT O)	DO_32		Unsigned32 Bitfield	-	1
4DO(+28 BIT I/O), DIA in I-PI	DO_DIA_32			1	1
* 4DO(-4 BIT O)	DO_0	75x-532*	-	-	-
* 4DO(-4 BIT I/O), DIA in I-PI	DO_DIA_0				

PNIO Module type	In-/Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
4DO(+4 BIT O) 4DO(+12 BIT O) 4DO(+28 BIT O)	4					O3	O2	O1	O0	8, 16 or 32 bits are allocated within the output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 to 2^3 are assigned to the output states of the physically connected I/O module. The bits 2^4 to 2^7, 2^{15} or 2^{31} marked green are made available for the output and/or acknowledgement states of the following module slots. One byte process data qualifier (IOCS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
4DO(+4 BIT I/O), DIA in I-PI 4DO(+12 BIT I/O), DIA in I-PI 4DO(+28 BIT I/O), DIA in I-PI	4					O3	O2	O1	O0	8, 16 or 32 bits are allocated within the input and output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 to 2^3 in the output area are assigned to the output states of the physically connected I/O module. The bits 2^4 to 2^7, 2^{15} or 2^{31} in the output area marked green are made available for the output and / or acknowledgement states of the following module slots. The bits 2^0 to 2^3 in the input area are assigned to the diagnostic states of the physically connected I/O module. The bits 2^4 to 2^7 , 2^{15} or 2^{31} in the input area marked green are made available for the input and / or diagnostic states of the following module slots. Two byte process data qualifiers (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
	4					D3	D2	D1	D0	
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								

PNIO Module type	In-/Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
* 4DO(-4 BIT O)	4			O3	O2	O1	O0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the output process image by configuration modules without a star to be assigned to the output states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
		O3	O2	O1	O0					
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
		...								
		O3	O2	O1	O0					
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
* 4DO(-4 BIT I/O), DIA in I-PI Output see * 4DO(-4 BIT O)	4			D3	D2	D1	D0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input and output process image by configuration modules without a star to be assigned to the output and diagnostic states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								
		D3	D2	D1	D0					
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								
		...								
		D3	D2	D1	D0					
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel x (x = 0 ... 3)		With external faults, channel diagnostics and the respective alarms are
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
Substitute value behavior of outputs		Applies when the IO controller does not supply valid output data for the module or the group of modules
	according to device settings*)	• the substitute strategy on the side of the station proxy applies (IO device).
	Outputs are set to zero	• all outputs are immediately reset
	Outputs are set to last valid states	• all outputs maintain the last valid value
	Outputs are set to substitute states	• all outputs switch to their configured substitute value
Output substitute state		When configuring the substitute value behavior on the side of the I/O module, these values are transmitted to the binary signal channel with invalid output states of the IO controller.
Channel x (x = 0 ... 3)	0*)	
	1	
	*) Default settings	

5.3.2.6 8-Channel Digital Output Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
8DO	**DO_8**	75x-530, 75x-534, 75x-536, 75x-1515, 75x-1516	Unsigned8 Bitfield	-	1
8DO(+8 BIT O)	**DO_16**		Unsigned16 Bitfield		
8DO(+24 BIT O)	**DO_32**		Unsigned32 Bitfield		
*** 8DO(-8 BIT O)**	**DO_0**	75x-530*, 75x-534*, 75x-536*, 75x-1515*, 75x-1516*	-	-	-

PNIO Module type	Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
8DO **8DO(+8 BIT O)** **8DO(+24 BIT O)**	8	O7	O6	O5	O4	O3	O2	O1	O0	8, 16 or 32 bits are allocated within the output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 to 2^7 are assigned to the output states of the physically connected I/O module. The bits 2^8 to 2^{15} or 2^{31} marked green are made available for the output and/or acknowledgement states of the following module slots. One byte process data qualifier (IOCS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
*** 8DO(-8 BIT O)**	8	O5	O4	O3	O2	O1	O0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the output process image by configuration modules without a star to be assigned to the ouput states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
								O7	O6	
		O3	O2	O1	O0					
						O7	O6	O5	O4	
		...								
		O7	O6	O5	O4	O3	O2	O1	O0	

General module/channel parameters		
Parameter	**Value**	**Significance**
Substitute value behavior of outputs		Applies when the IO controller does not supply valid output data for the module or the group of modules
	according to device settings*)	• the substitute strategy on the side of the station proxy applies (IO device).
	Outputs are set to zero	• all outputs are immediately reset
	Outputs are set to last valid states	• all outputs maintain the last valid value
	Outputs are set to substitute states	• all outputs switch to their configured substitute value
Output substitute state		When configuring the substitute value behavior on the side of the I/O module, these values are transmitted to the binary signal channel with invalid output states of the IO controller.
Channel x (x = 0 ... 7)	0*)	
	1	
	*) Default settings	

5.3.2.7 8-Channel Digital Output Modules with 1 Bit Diagnostics per Channel

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
8DO	**DO_8**	75x-537	Unsigned8 Bitfield	-	1
8DO, DIA in I-PI	**DO_DIA_8**			1	1
8DO(+8 BIT O)	**DO_16**		Unsigned16 Bitfield	-	1
8DO(+8 BIT I/O), DIA in I-PI	**DO_DIA_16**			1	1
8DO(+24 BIT O)	**DO_32**		Unsigned32 Bitfield	-	1
8DO(+24 BIT I/O), DIA in I-PI	**DO_DIA_32**			1	1
*** 8DO(-8 BIT O)**	**DO_0**	75x-537*	-	-	-
*** 8DO(-8 BIT I/O), DIA in I-PI**	**DO_DIA_0**				

PNIO Module type	In-/Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
8DO **8DO(+8 BIT O)** **8DO(+24 BIT O)**	8	O7	O6	O5	O4	O3	O2	O1	O0	8, 16 or 32 bits are allocated within the output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 to 2^7 are assigned to the output states of the physically connected I/O module. The bits 2^8 to 2^{15} or 2^{31} marked green are made available for the output and/or acknowledgement states of the following module slots. One byte process data qualifier (IOCS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
8DO, DIA in I-PI **8DO(+8 BIT I/O), DIA in I-PI** **8DO(+24 BIT I/O), DIA in I-PI**	8	O7	O6	O5	O4	O3	O2	O1	O0	8, 16 or 32 bits are allocated within the input and output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 to 2^7 in the output area are assigned to the output states of the physically connected I/O module. The bits 2^8 to 2^{15} or 2^{31} in the output area marked green are made available for the output and / or acknowledgement states of the following module slots. The bits 2^0 to 2^7 in the input area are assigned to the diagnostic states of the physically connected I/O module. The bits 2^8 to 2^{15} or 2^{31} in the input area marked green are made available for the input and/or diagnostic states of the following module slots. Two byte process data qualifiers (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
	8	D7	D6	D5	D4	D3	D2	D1	D0	
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								

PNIO Module type	In-/Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
*** 8DO(-8 BIT O)**	8	O5	O4	O3	O2	O1	O0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the output process image by configuration modules without a star to be assigned to the output states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
								O7	O6	
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
		O3	O2	O1	O0					
						O7	O6	O5	O4	
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
		. . .								
		O7	O6	O5	O4	O3	O2	O1	O0	
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
*** 8DO(-8 BIT I/O), DIA in I-PI** **Output see** *** 8DO(-8 BIT O)**	8	D5	D4	D3	D2	D1	D0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input and output process image by configuration modules without a star to be assigned to the output an diagnostic states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
								D7	D6	
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
		D3	D2	D1	D0					
						D7	D6	D5	D4	
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
		. . .								
		D7	D6	D5	D4	D3	D2	D1	D0	
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel x (x = 0 ... 7)		With external faults, channel diagnostics and the respective alarms are
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
Substitute value behavior of outputs		Applies when the IO controller does not supply valid output data for the module or the group of modules
	according to device settings*)	• the substitute strategy on the side of the station proxy applies (IO device).
	Outputs are set to zero	• so that all outputs are immediately reset
	Outputs are set to last valid states	• that all outputs maintain the last valid value
	Outputs are set to substitute states	• so that all outputs switch to their configured default value
Output substitute state		With the respective configuration of the default value behavior on the side of the I/O module, these values are released to binary signal channels with invalid output station of the IO controller.
Channel x (x = 0 ... 7)	0*)	
	1	
	*) Default settings	

5.3.2.8 16-Channel Digital Output Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
16DO	**DO_16**	750-1500, 750-1501, 75x-1504, 75x-1505	Unsigned16 Bitfield	-	1
16DO(+16 BIT O)	**DO_32**		Unsigned32 Bitfield		
*** 16DO(-16 BIT O)**	**DO_0**	750-1500*, 750-1501*, 75x-1504*, 75x-1505*	-	-	-

PNIO Module type	Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
16DO	16	O7	O6	O5	O4	O3	O2	O1	O0	16 or 32 bits are allocated within the output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 to 2^{15} are assigned to the output states of the physically connected I/O module. The bits 2^{16} to 2^{31} marked green are made available for the output and/or acknowledgement states of the following module slots. One byte process data qualifier (IOCS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
16DO(+16 BIT O)		O15	O14	O13	O12	O11	O10	O9	O8	
*** 16DO(-16 BIT O)**	16	O5	O4	O3	O2	O1	O0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the output process image by configuration modules without a star to be assigned to the output states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		O13	O12	O11	O10	O9	O8	O7	O6	
								O15	O14	
		O3	O2	O1	O0					
		O11	O10	O9	O8	O7	O6	O5	O4	
						O15	O14	O13	O12	
		...								
		O7	O6	O5	O4	O3	O2	O1	O0	
		O15	O14	O13	O12	O11	O10	O9	O8	

General module/channel parameters		
Parameter	**Value**	**Significance**
Substitute value behavior of outputs		Applies when the IO controller does not supply valid output data for the module or the group of modules
	according to device settings*)	• the substitute strategy on the side of the station proxy applies (IO device).
	Outputs are set to zero	• so that all outputs are immediately reset
	Outputs are set to last valid states	• that all outputs maintain the last valid value
	Outputs are set to substitute states	• so that all outputs switch to their configured default value
Output substitute state		With the respective configuration of the default value behavior on the side of the I/O module, these values are released to binary signal channels with invalid output station of the IO controller.
Channel x (x = 0 ... 15)	0*)	
	1	
	*) Default settings	

5.3.2.9 8-Channel Digital Input-/Output Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
8DIO	DIO_8	750-1502, 75x-1506	Unsigned8 Bitfield	-	1
8DIO(+8 BIT I/O)	DIO_16		Unsigned16 Bitfield		
8DIO(+24 BIT I/O)	DIO_32		Unsigned32 Bitfield		
* 8DIO(-8 BIT I/O)	DIO_0	750-1502*, 75x-1506*	-	-	-

PNIO Module type	In-/Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
8DIO 16DIO(+8 BIT I/O) 32DIO(+24 BIT I/O)	8	O7	O6	O5	O4	O3	O2	O1	O0	8, 16 or 32 bits are allocated within the input and output process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 to 2^7 in the output area are assigned to the output states of the physically connected I/O module. The bits 2^8 to 2^{15} or 2^{31} in the output area marked green are made available for the output and / or acknowledgement states of the following module slots. The bits 2^0 to 2^7 in the input area are assigned to the input states of the physically connected I/O module. The bits 2^8 to 2^{15} or 2^{31} in the input area marked green are made available for the input and / or diagnostic states of the following module slots. Two byte process data qualifiers (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
	8	I7	I6	I5	I4	I3	I2	I1	I0	
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								

PNIO Module type	In-/Outputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
*** 8DIO(-8 BIT I/O)**	8	O5	O4	O3	O2	O1	O0			The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input and output process image by configuration modules without a star to be assigned to the input and ouput states of the physically connected I/O module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
								O7	O6	
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
		O3	O2	O1	O0					
						O4	O3	O2	O1	
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
		...								
		O7	O6	O5	O4	O3	O2	O1	O0	
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
	8	I5	I4	I3	I2	I1	I0			
								I7	I6	
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								
		I3	I2	I1	I0					
						I7	I6	I5	I4	
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								
		...								
		I7	I6	I5	I4	I3	I2	I1	I0	
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								

General module/channel parameters		
Parameter	**Value**	**Significance**
Substitute value behavior of outputs		Applies when the IO controller does not supply valid output data for the module or the group of modules
	according to device settings*)	• the substitute strategy on the side of the station distributor applies (IO device).
	Outputs are set to zero	• all outputs are immediately reset
	Outputs are set to last valid states	• all outputs maintain the last valid value
	Outputs are set to substitute states	• all outputs maintain the last valid value
Output substitute state		When configuring the substitute value behavior on the side of the I/O module, these values are transmitted to the binary signal channel with invalid output states of the IO controller.
Channel x (x = 0 … 7)	0*)	
	1	
	*) Default setting	

5.3.3 Analog Input Modules

5.3.3.1 2-Channel Analog Input Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances Input	Instances Output
2AI	**AI**	75x-452, 75x-454, 75x-456, 75x-461, 75x-462, 75x-464, 75x-465, 75x-466, 75x-467, 75x-469, 75x-470, 75x-472, 75x-473, 75x-474, 75x-475, 75x-476, 75x-477, 75x-478, 75x-479, 75x-480, 75x-481, 75x-483, 75x-485, 75x-487, 75x-491, 75x-492	Integer16	2	-
2AI, EM	**AI_EM**		Unsigned8 Integer16	2	2

PNIO Module type	In-/Outputs: Length [Byte]	Bit (Byte) allocation (2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0)	Note
2AI	4	Input data Channel 0, HB[4] (LB[5])	2 words (4 bytes) are allocated within the input process image of the station proxy (fieldbus coupler) and are assigned to the physical signal channels of the I/O module by assembling a slot with this configuration module. The words' byte order is depending on the adjusted process data representation. One bytes process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Input data Channel 0, LB[4] (HB[5])	
		Input data Channel 1, HB[4] (LB[5])	
		Input data Channel 1, LB[4] (HB[5])	
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /	
2AI, EM	6	PD RA | F | Status / Register RES Channel 0 / Table 0	2 bytes and 2 words (4 bytes) are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical signal channels of the I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. The words' byte order is depending on the adjusted process data representation. The output data are unused during standard communication. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Input data / Register data RD Channel 0 / Table 0, HB[4] (LB[5])	
		Input data / Register data RD Channel 0 / Table 0, LB[4] (HB[5])	
		PD RA | F | Status / Register RES Channel 1 / Table 1	
		Input data / Register data RD Channel 1 / Table 1, HB[4] (LB[5])	
		Input data / Register data RD Channel 1 / Table 1, LB[4] (HB[5])	
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /	
	6	PD RA | RW | Register REQ Table 0	
		Register data WR Table 0, HB[4] (LB[5])	
		Register data WR Table 0, LB[4] (HB[5])	
		PD RA | RW | Register REQ Table 1	
		Register data WR Table 1, HB[4] (LB[5])	
		Register data WR Table 0, LB[4] (HB[5])	
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /	
	[4] MOTOROLA format [5] INTEL format		

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel x (x = 0, 1)		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
Process data representation		The process data will be transferred
Channel x (x = 0, 1)	according to device settings*)	• Using the format settings of the IO device.
	INTEL (LSB-MSB)	• Little Endian format
	MOTOROLA (MSB-LSB)	• Big Endian format
	*) Default settings	

Specific modul/channel parameters for 75x-464		
Parameter	**Value**	**Significance**
Operating mode	2-Channel2)	2-conductor mode
Sensor type		The sensor is of the type
	Pt 100 (IEC 751)*)	• Thermo resistance Pt 100
	Ni 100 (DIN 43760)	• Thermo resistance Ni 100
	Pt 1000 (IEC 751)	• Thermo resistance Pt 1000
	Pt 500 (IEC 751)	• Thermo resistance Pt 500
	Pt 200 (IEC 751)	• Thermo resistance Pt 200
	Ni 1000 (DIN 43760)	• Thermo resistance Ni 1000
	Ni 120 (Minco)	• Thermo resistance Ni 120
	Ni 1000 (TK 5000)	• Thermo resistance Ni 1000
	Potentiometer1)	• Potentiometer
	Resistance 10R …5k (linear)	• Resistance 10R-5k (linear)
	Resistance 10R… 1k2 (linear)	• Resistance 10R-1k2 (linear)
Connection type		The sensor connected via
	2-wire connection	• 2 conductors
	3-wire connection	• 3 conductors
	*) Default setting	
	1) only possible for 2-wire connection	
	2) not changeable	

5.3.3.2 3-Channel Analog Input Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
3AI, EM	**AI_EM**	75x-493	Unsigned8[2] Integer16	3	3

PNIO Module type	In-/Outputs									
	Length [Byte]	Bit (Byte) allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
3AI, EM	12	PD RA	F	Status / Register RES Channel 0 / Table 0						6 bytes and 3 words (6 bytes) are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical signal channels of the I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. The words' byte order is depending on the adjusted process data representation. The output data are unused during standard communication. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Input data / Register data RD Channel 0 / Table 0, HB[4] (LB[5])								
		Input data / Register data RD Channel 0 / Table 0, LB[4] (HB[5])								
		PD RA	F	Status / Register RES Channel 1 / Table 1						
		Input data / Register data RD Channel 1 / Table 1, HB[4] (LB[5])								
		Input data / Register data RD Channel 1 / Table 1, LB[4] (HB[5])								
		PD RA	F	Status / Register RES Channel 2 / Table 2						
		Input data / Register data RD Channel 2 / Table 2, HB[4] (LB[5])								
		Input data / Register data RD Channel 2 / Table 2, LB[4] (HB[5])								
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								
	12	PD RA	RW	Register REQ Table 0						
		Register data WR Table 0, HB[4] (LB[5])								
		Register data WR Table 0, LB[4] (HB[5])								
		PD RA	RW	Register REQ Table 1						
		Register data WR Table 1, HB[4] (LB[5])								
		Register data WR Table 1, LB[4] (HB[5])								
		PD RA	RW	Register REQ Table 2						
		Register data WR Table 2, HB[4] (LB[5])								
		Register data WR Table 2, LB[4] (HB[5])								
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
	[4] MOTOROLA format [5] INTEL format									

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel x (x = 0 … 2)		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
Process data representation		The process data will be transferred
Channel x (x = 0 … 2)	according to device settings*)	• using the format settings of the IO device.
	INTEL (LSB-MSB)	• Little Endian format
	MOTOROLA (MSB-LSB)	• Big Endian format
	*) Default settings	

5.3.3.3 4-Channel Analog Input Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
4AI	**AI**	75x-453, 75x-455, 75x-457, 75x-459, 75x-460, 75x-464, 75x-468	Integer16	4	-
4AI, EM	**AI_EM**		Unsigned8 Integer16	4	4

<table>
<tr><th rowspan="3">PNIO
Module type</th><th colspan="10">In-/Outputs</th></tr>
<tr><th rowspan="2">Length
[Byte]</th><th colspan="8">Bit (Byte) allocation</th><th rowspan="2">Note</th></tr>
<tr><th>2^7</th><th>2^6</th><th>2^5</th><th>2^4</th><th>2^3</th><th>2^2</th><th>2^1</th><th>2^0</th></tr>
<tr><td rowspan="9">4AI</td><td rowspan="9">8</td><td colspan="8">Input data Channel 0, HB[4] (LB[5])</td><td rowspan="9">4 words (8 bytes) are allocated within the output process image of the station proxy (fieldbus coupler) and are assigned to the physical signal channels of the I/O module by assembling a slot with this configuration module. The words' byte order is depending on the adjusted process data representation. One bytes process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.</td></tr>
<tr><td colspan="8">Input data Channel 0, LB[4] (HB[5])</td></tr>
<tr><td colspan="8">Input data Channel 1, HB[4] (LB[5])</td></tr>
<tr><td colspan="8">Input data Channel 1, LB[4] (HB[5])</td></tr>
<tr><td colspan="8">Input data Channel 2, HB[4] (LB[5])</td></tr>
<tr><td colspan="8">Input data Channel 0, HB[4] (LB[5])</td></tr>
<tr><td colspan="8">Input data Channel 3, HB[4] (LB[5])</td></tr>
<tr><td colspan="8">Input data Channel 0, HB[4] (LB[5])</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /</td></tr>
</table>

PNIO Module type	In-/Outputs									
	Length [Byte]	Bit (Byte) allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
4AI, EM	12	PD RA	F	Status / Register RES Channel 0 / Table 0						4 bytes and 4 words (8 bytes) are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical signal channels of the I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. The words' byte order is depending on the adjusted process data representation. The output data are unused during standard communication. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Input data / Register data RD Channel 0 / Table 0, HB[4] (LB[5])								
		Input data / Register data RD Channel 0 / Table 0, LB[4] (HB[5])								
		PD RA	F	Status / Register RES Channel 1 / Table 1						
		Input data / Register data RD Channel 1 / Table 1, HB[4] (LB[5])								
		Input data / Register data RD Channel 1 / Table 1, LB[4] (HB[5])								
		PD RA	F	Status / Register RES Channel 2 / Table 2						
		Input data / Register data RD Channel 2 / Table 2, HB[4] (LB[5])								
		Input data / Register data RD Channel 2 / Table 2, LB[4] (HB[5])								
		PD RA	F	Status / Register RES Channel 3 / Table 1						
		Input data / Register data RD Channel 3 / Table 3, HB[4] (LB[5])								
		Input data / Register data RD Channel 3 / Table 3, LB[4] (HB[5])								
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
	12	PD RA	RW	Register REQ Table 0						
		Register data WR Table 0, HB[4] (LB[5])								
		Register data WR Table 0, LB[4] (HB[5])								
		PD RA	RW	Register REQ Table 1						
		Register data WR Table 1, HB[4] (LB[5])								
		Register data WR Table 1, LB[4] (HB[5])								
		PD RA	RW	Register REQ Table 2						
		Register data WR Table 2, HB[4] (LB[5])								
		Register data WR Table 2, LB[4] (HB[5])								
		PD RA	RW	Register REQ Table 3						
		Register data WR Table 3, HB[4] (LB[5])								
		Register data WR Table 3, LB[4] (HB[5])								
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
	[4] MOTOROLA format [5] INTEL format									

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel x (x = 0 ... 3)		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
Process data representation		The process data will be transferred
Channel x (x = 0 ... 3)	according to device settings*)	• using the format settings of the IO device.
	INTEL (LSB-MSB)	• Little Endian format
	MOTOROLA (MSB-LSB)	• Big Endian format
	*) Default settings	

Specific modul/channel parameters for 75x-464		
Parameter	**Value**	**Significance**
Operating mode	4-Channel[1)]	4-conductor mode
Sensor type		The sensor is of the type
	Pt 100 (IEC 751)*)	• Thermo resistance Pt 100
	Ni 100 (DIN 43760)	• Thermo resistance Ni 100
	Pt 1000 (IEC 751)	• Thermo resistance Pt 1000
	Pt 500 (IEC 751)	• Thermo resistance Pt 500
	Pt 200 (IEC 751)	• Thermo resistance Pt 200
	Ni 1000 (DIN 43760)	• Thermo resistance Ni 1000
	Ni 120 (Minco)	• Thermo resistance Ni 120
	Ni 1000 (TK 5000)	• Thermo resistance Ni 1000
Connection type		The sensor connected via
	2-wire connection*) [1)]	• 2 conductors
	*) Default setting	
	1) not changeable	

Spezific module/channel parameters for 75x-464/020-000		
Parameter	**Value**	**Significance**
Operating mode	4-Channel[1)]	4-conductor mode
Sensor type		The sensor is of the type
	NTC 10 k*)	• Thermo resistance NTC 10 kΩ
	NTC 20 k	• Thermo resistance NTC 20 kΩ
	NTC-Thermokon 10 k	• Thermo resistance NTC 10 kΩ Thermokon
Connection type		The sensor connected via
	2-wire connection*)[1)]	• 2 conductors
	*) Default setting	
	1) not changeable	

5.3.4 Analog Output Modules

5.3.4.1 2-Channel Analog Output Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
2AO	**AO**	75x-550, 75x-552, 75x-554, 75x-556, 75x-560, 75x-562, 75x-563, 75x-585	Integer16	-	2
2AO, EM	**AO_EM**		Unsigned8 Integer16	2	2

PNIO Module type	In-/Outputs				
	Length [Byte]	Bit (Byte) allocation			Note
		2^7	2^6	2^5 2^4 2^3 2^2 2^1 2^0	
2AO	4	Output data Channel 0, HB[4] (LB[5])			2 words (4 bytes) are allocated within the output process image of the station proxy (fieldbus coupler) and are assigned to the physical signal channels of the I/O module by assembling a slot with this configuration module. The words' byte order is depending on the adjusted process data representation. One bytes process data qualifier (IOCS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Output data Channel 0, LB[4] (HB[5])			
		Output data Channel 1, HB[4] (LB[5])			
		Output data Channel 1, LB[4] (HB[5])			
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /			
2AO, EM	6	PD RA	F	Status / Register RES Channel 0 / Table 0	2 bytes an 2 words (4 bytes) are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical signal channels of the I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. The words' byte order is depending on the adjusted process data representation. The input data are unused during standard communication. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Register data RD Table 0, HB[4] (LB[5])			
		Register data RD Table 0, LB[4] (HB[5])			
		PD RA	F	Status / Register RES Channel 1 / Table 1	
		Register data RD Table 1, HB[4] (LB[5])			
		Register data RD Table 1, LB[4] (HB[5])			
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /			
	6	PD RA	RW	Register REQ Table 0	
		Output data / Register data WR Channel 0 / Table 0, HB[4] (LB[5])			
		Output data / Register data WR Channel 0 / Table 0, LB[4] (HB[5])			
		PD RA	RW	Register REQ Table 1	
		Output data / Register data WR Channel 1 / Table 1, HB[4] (LB[5])			
		Output data / Register data WR Channel 1 / Table 1, LB[4] (HB[5])			
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /			
	[4] MOTOROLA format [5] INTEL format				

General module/channel parameters		
Parameter	**Value**	**Significance**
Substitute value behavior of outputs		Applies when the IO controller does not supply valid output data for the module or the group of modules
	according to device settings*)	• the substitute strategy on the side of the station proxy applies (IO device).
	Outputs are set to zero	• all outputs are immediately reset
	Outputs are set to last valid values	• all outputs maintain the last valid value
	Outputs are set to substitute values	• all outputs switch to their configured substitute value
Asynch. diagnostic message Channel x (x = 0, 1)1)		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
Process data representation		The process data will be transferred
Channel x (x = 0, 1)	according to device settings*)	• using the format settings of the IO device.
	INTEL (LSB-MSB)	• Little Endian Format
	MOTOROLA (MSB-LSB)	• Big Endian Format
Output substitute value		If the switching of substitute values has been selected as a fault strategy, the substitute output data of the individual output channels can be determined here.
Channel x (x = 0, 1)	0x0000*) – 0x7FFF	
	or	
	0x0000*) – 0xFFFF	
	*) Default setting	
	1) Existence module-dependently	

Spezific module/channel parameters for 75x-562 und 75x-563		
Parameter	**Value**	**Significance**
User scale		User scaling
	disabled*)	• switched off
	enabled	• switched on
Calibration		The calibration takes place trough
	User	• User
	Factory*)	• Manufacturer
Number representation		The process data follows the representation
	Twos complement*)	• Twos complement
	Value plus sign	• Amount plus leading sign
Operating mode		The appropriate output channel works within the range
75x-562	0-10 V*)	• 0 … 10 V
	+/-10 V	• +/-10 V
75x-563	0-20 mA	• 0 … 20 mA
	4-20 mA*)	• 4 … 20 mA
	6-18 V	• 6 … 18 V
On exceeding user limits		If the limit value on the part of the output data is exceeded, the output value
	No limitation of output value*)	• is not limited
	Limitation of output value	• is limited
Output		The appropriate exit
	in parameterized operating mode*)	• works in the parameterized mode of operation
	high-impedance	• is high-impedance deactivated
Behavior on K-Bus timeout		With the K-Bus monitoring of the response time of 100 ms
75x-562	output 0 V*)	• the appropriate output is 0 V
75x-563	output 0 mA or 6 V*)	• the appropriate output spends 0 mA or 6 V depends of operation mode
	keep last output value	• the appropriate output holds the last output value
	output factory substitute value	• the manufacturer substitution value is spent
	switch output high-impedance	• the appropriate output is high impedance switched
	output user substitute value	• the user substitute value is spent

Spezific module/channel parameters for 75x-562 und 75x-563		
Parameter	**Value**	**Significance**
Switch-on delay (s)		After disconnection of the appropriate output by excess of the maximum operating temperature after restarting takes place
	0	• immediately
	0.10	• after 0.1 s
	0.20	• after 0.2 s
	0.30	• after 0.3 s
	0.50*)	• after 0.5 s
	0.75	• after 0.75 s
	1.00	• after 1 s
	2.00	• after 2 s
	*) Default setting	

5.3.4.2 4-Channel Analog Output Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
4AO	**AO**	75x-553, 75x-555, 75x-557, 75x-559	Integer16	-	4
4AO, EM	**AO_EM**		Unsigned8 Integer16	4	4

<table>
<tr><th rowspan="3">PNIO
Module type</th><th colspan="10">In-/Outputs</th></tr>
<tr><th rowspan="2">Length
[Byte]</th><th colspan="8">Bit (Byte) allocation</th><th rowspan="2">Note</th></tr>
<tr><th>2^7</th><th>2^6</th><th>2^5</th><th>2^4</th><th>2^3</th><th>2^2</th><th>2^1</th><th>2^0</th></tr>
<tr><td rowspan="9">4AO</td><td rowspan="9">8</td><td colspan="8">Output data Channel 0, HB[4] (LB[5])</td><td rowspan="9">4 words (8 bytes) are allocated within the output process image of the station proxy (fieldbus coupler) and are assigned to the physical signal channels of the I/O module by assembling a slot with this configuration module. The words' byte order is depending on the adjusted process data representation. One byte process data qualifier (IOCS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.</td></tr>
<tr><td colspan="8">Output data Channel 0, LB[4] (HB[5])</td></tr>
<tr><td colspan="8">Output data Channel 1, HB[4] (LB[5])</td></tr>
<tr><td colspan="8">Output data Channel 1, LB[4] (HB[5])</td></tr>
<tr><td colspan="8">Output data Channel 2, HB[4] (LB[5])</td></tr>
<tr><td colspan="8">Output data Channel 2, LB[4] (HB[5])</td></tr>
<tr><td colspan="8">Output data Channel 3, HB[4] (LB[5])</td></tr>
<tr><td colspan="8">Output data Channel 3, LB[4] (HB[5])</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /</td></tr>
</table>

PNIO Module type	In-/Outputs									
	Length [Byte]	Bit (Byte) allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
4AO, EM	12	PD RA	F	Status / Register RES Channel 0 / Table 0						4 bytes and 4 words (8 bytes) are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical signal channels of the I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. The words' byte order is depending on the adjusted process data representation. The input data are unused during standard communication. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Register data RD Table 0, HB[4] (LB[5])								
		Register data RD Table 0, LB[4] (HB[5])								
		PD RA	F	Status / Register RES Channel 1 / Table 1						
		Register data RD Table 1, HB[4] (LB[5])								
		Register data RD Table 1, LB[4] (HB[5])								
		PD RA	F	Status / Register RES Channel 2 / Chart 2						
		Register data RD Table 2, HB[4] (LB[5])								
		Register data RD Table 2, LB[4] (HB[5])								
		PD RA	F	Status / Register RES Channel 3 / Chart 3						
		Register data RD Table 3, HB[4] (LB[5])								
		Register data RD Table 3, LB[4] (HB[5])								
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
	12	PD RA	RW	Register REQ Table 0						
		Output data / Register data WR Channel 0 / Table 0, HB[4] (LB[5])								
		Output data / Register data WR Channel 0 / Table 0, LB[4] (HB[5])								
		PD RA	RW	Register REQ Table 1						
		Output data / Register data WR Channel 1 / Table 1, HB[4] (LB[5])								
		Output data / Register data WR Channel 1 / Table 1, LB[4] (HB[5])								
		PD RA	RW	Register REQ Table 2						
		Output data / Register data WR Channel 2 / Table 2, HB[4] (LB[5])								
		Output data / Register data WR Channel 2 / Table 2, LB[4] (HB[5])								
		PD RA	RW	Register REQ Table 3						
		Output data / Register data WR Channel 3 / Table 3, HB[4] (LB[5])								
		Output data / Register data WR Channel 3 / Table 3, LB[4] (HB[5])								
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
	[4] MOTOROLA format [5] INTEL format									

General module/channel parameters		
Parameter	**Value**	**Significance**
Substitute value behavior of outputs		Applies when the IO controller does not supply valid output data for the module or the group of modules
	according to device settings*)	• the substitute strategy on the side of the station proxy applies (IO device).
	Outputs are set to zero	• so that all outputs are immediately reset
	Outputs are set to last valid value	• all outputs maintain the last valid value
	Outputs are set to substitute values	• all outputs switch to their configured substitute value
Asynch. diagnostic message Channel x (x = 0 ... 3)		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
Process data representation		The process data will be transferred
Channel x (x = 0 ... 3)	according to device settings*)	• using the format settings of the IO device.
	INTEL (LSB-MSB)	• Little Endian Format
	MOTOROLA (MSB-LSB)	• Big Endian Format
Output substitute value		If the switching of substitute values has been selected as a fault strategy, the substitute output data of the individual output channels can be determined here.
Channel x (x = 0 ... 3)	0x0000*) – 0x7FFF	
	or	
	0x0000*) – 0xFFFF	
	*) Default settings	

5.3.5 Special Modules

5.3.5.1 Up/Down Counter

PNIO Module type	Module type member	PNIO Data type	Instances	
			Input	Output
1CNT	75x-404	Unsigned8[2] Integer32	1	1
2CNT	75x-638	Unsigned8 Integer16	2	2

PNIO Module type	In-/Outputs									
	Length [Byte]	**Bit (Byte) allocation**								**Note**
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
1CNT	6	PD RA	-	Status / Register RES Channel 0 / Table 0						2 bytes and 1 double word (4 bytes) are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. The word's byte order is depending on the adjusted process data representation. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module
		Counter value Channel 0 Byte 3[4] (Byte 0[5])				Register data RD Table 0, LB[5]				
		Counter value Channel 0 Byte 2[4] (Byte 1[5])				Register data RD Table 0, HB[5]				
		Counter value Channel 0 Byte 1[4] (Byte 2[5])				Register data RD Table 0, HB[4]				
		Counter value Channel 0 Byte 0[4] (Byte 3[5])				Register data RD Table 0, LB[4]				
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
	6	PD RA	RW	Control / Register REQ Channel 0 / Table 0						
		Counter set value Channel 0 Byte 3[4] (Byte 0[5])				Register data RD Table 0, LB[5]				
		Counter set value Channel 0 Byte 2[4] (Byte 1[5])				Register data RD Table 0, HB[5]				
		Counter set value Channel 0 Byte 1[4] (Byte 2[5])				Register data RD Table 0, HB[4]				
		Counter set value Channel 0 Byte 0[4] (Byte 3[5])				Register data RD Table 0, LB[4]				
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								

PNIO Module type	In-/Outputs									
	Length [Byte]	Bit (Byte) allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
2CNT	6	PD RA	-	Status / Register RES Channel 0 / Table 0						2 bytes and 2 words (4 bytes) are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. The words' byte order is depending on the adjusted process data representation. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Counter value Channel 0 HB[4] (LB[5])				Register data RD Table 0, HB[4] (LB[5])				
		Counter value Channel 0 LB[4] (HB[5])				Register data RD Table 0, LB[4] (HB[5])				
		PD RA	-	Status / Register RES Channel 1 / Table 1						
		Counter value Channel 1 HB[4] (LB[5])				Register data RD Table 1, HB[4] (LB[5])				
		Counter value Channel 1 HB[4] (LB[5])				Register data RD Table 1, LB[4] (HB[5])				
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								
	6	PD RA	RW	Control / Register REQ Channel 0 / Table 0						
		Counter set value Channel 0 HB[4] (LB[5])				Register data WR Table 0, HB[4] (LB[5])				
		Counter set value Channel 0 LB[4] (HB[5])				Register data WR Table 0, LB[4] (HB[5])				
		PD RA	RW	Control / Register REQ Channel 1 / Table 1						
		Counter set value Channel 1 HB[4] (LB[5])				Register data WR Table 1, HB[4] (LB[5])				
		Counter set value Channel 1 LB[4] (HB[5])				Register data WR Table 1, LB[4] (HB[5])				
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
	[4] MOTOROLA format [5] INTEL format									

General module/channel parameters		
Parameter	**Value**	**Significance**
Process data representation		The process data will be transferred
Channel x (x = 0, 1)	according to device settings*)	• using the format settings of the IO device.
	INTEL (LSB-MSB)	• Little Endian Format
	MOTOROLA (MSB-LSB)	• Big Endian Format
	*) Default settings	

5.3.5.2 2-Channel Pulse Width Output Module

<table>
<tr><th rowspan="2">PNIO
Module type</th><th rowspan="2">EA Type</th><th rowspan="2">Module type member</th><th rowspan="2">PNIO Data type</th><th colspan="2">Instances</th></tr>
<tr><th>Input</th><th>Output</th></tr>
<tr><td>**2PWM**</td><td>**PWM**</td><td rowspan="2">75x-511</td><td>Integer16</td><td>-</td><td>2</td></tr>
<tr><td>**2PWM, EM**</td><td>**PWM_EM**</td><td>Unsigned8
Integer16</td><td>2</td><td>2</td></tr>
</table>

<table>
<tr><th rowspan="3">PNIO
Module type</th><th colspan="10">In-/Outputs</th></tr>
<tr><th rowspan="2">Length
[Byte]</th><th colspan="8">Bit (Byte) allocation</th><th rowspan="2">Note</th></tr>
<tr><th>2^7</th><th>2^6</th><th>2^5</th><th>2^4</th><th>2^3</th><th>2^2</th><th>2^1</th><th>2^0</th></tr>
<tr><td rowspan="6">**2PWM**</td><td rowspan="6">4</td><td colspan="8">Output data
Channel 0 HB[4] (LB[5])</td><td rowspan="6">2 words (4 bytes) are allocated within the output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. The words' byte order is depending on the adjusted process data representation. One byte process data qualifier (IOCS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.</td></tr>
<tr><td colspan="8">Output data
Channel 0 LB[4] (HB[5])</td></tr>
<tr><td colspan="8">Output data
Channel 1 HB[4] (LB[5])</td></tr>
<tr><td colspan="8">Output data
Channel 1 LB[4] (HB[5])</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td rowspan="14">**2PWM, EM**</td><td rowspan="7">6</td><td>PD
RA</td><td>-</td><td colspan="6">Status / Register RES
Channel 0 / Table 0</td><td rowspan="14">2 bytes and 2 words (4 bytes) are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. The words' byte order is depending on the adjusted process data representation. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.</td></tr>
<tr><td colspan="4">Input data
Channel 0 HB[4] (LB[5])</td><td colspan="4">Register data RD
Table 0, HB[4] (LB[5])</td></tr>
<tr><td colspan="4">Input data
Channel 0 LB[4] (HB[5])</td><td colspan="4">Register data RD
Table 0, LB[4] (HB[5])</td></tr>
<tr><td>PD
RA</td><td>-</td><td colspan="6">Status / Register RES
Channel 1 / Table 1</td></tr>
<tr><td colspan="4">Input data
Channel 1 HB[4] (LB[5])</td><td colspan="4">Register data RD
Table 1, HB[4] (LB[5])</td></tr>
<tr><td colspan="4">Input data
Channel 1 LB[4] (HB[5])</td><td colspan="4">Register data RD
Table 1, LB[4] (HB[5])</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /</td></tr>
<tr><td rowspan="7">6</td><td>PD
RA</td><td>RW</td><td colspan="6">Control / Register REQ
Channel 0 / Table 0</td></tr>
<tr><td colspan="4">Output data
Channel 0 HB[4] (LB[5])</td><td colspan="4">Register data WR
Table 0, HB[4] (LB[5])</td></tr>
<tr><td colspan="4">Output data
Channel 0 LB[4] (HB[5])</td><td colspan="4">Register data WR
Table 0, LB[4] (HB[5])</td></tr>
<tr><td>PD
RA</td><td>RW</td><td colspan="6">Control / Register REQ
Channel 1 / Table 1</td></tr>
<tr><td colspan="4">Output data
Channel 1 HB[4] (LB[5])</td><td colspan="4">Register data WR
Table 1, HB[4] (LB[5])</td></tr>
<tr><td colspan="4">Output data
Channel 1 LB[4] (HB[5])</td><td colspan="4">Register data WR
Table 1, LB[4] (HB[5])</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /</td></tr>
<tr><td></td><td colspan="9">[4] MOTOROLA format
[5] INTEL format</td><td></td></tr>
</table>

General module/channel parameters		
Parameter	**Value**	**Significance**
Substitute value behavior of outputs		Applies when the IO controller does not supply valid output data for the module or the group of modules
	according to device settings*)	• the substitute strategy on the side of the station proxy applies (IO device).
	Outputs are set to zero	• all outputs are immediately reset
	Outputs are set to last valid states	• all outputs maintain the last valid value
	Outputs are set to substitute states	• all outputs switch to their configured substitute value
Process data representation		The process data will be transferred
Channel x (x = 0, 1)	according to device settings*)	• transfer the settings of the IO device.
	INTEL (LSB-MSB)	• Little Endian Format
	MOTOROLA (MSB-LSB)	• Big Endian Format
Substitute output data		If the switching of substitute values has been selected as a fault strategy, the substitute output data of the individual output channels can be determined here.
Channel x (x = 0, 1)	0x0000*) – 0x7FFF	
	or	
	0x0000*) – 0xFFFF	
	*) Default settings	

5.3.5.3 Pulse Train Output Module

<table>
<tr><th rowspan="2">PNIO Module type</th><th rowspan="2">IO Type</th><th rowspan="2">Module type member</th><th rowspan="2">PNIO Data type</th><th colspan="2">Instances</th></tr>
<tr><th>Input</th><th>Output</th></tr>
<tr><td>1PT, EM</td><td>PT_EM</td><td>75x-639</td><td>Unsigned8[2],
Signed16</td><td>1</td><td>1</td></tr>
</table>

<table>
<tr><th rowspan="3">PNIO Module type</th><th colspan="10">In-/Outputs</th></tr>
<tr><th rowspan="2">Length [Byte]</th><th colspan="8">Bit (Byte) allocation</th><th rowspan="2">Note</th></tr>
<tr><th>2^7</th><th>2^6</th><th>2^5</th><th>2^4</th><th>2^3</th><th>2^2</th><th>2^1</th><th>2^0</th></tr>
<tr><td rowspan="10">1PT, EM</td><td rowspan="5">6</td><td>PD
RA</td><td>F</td><td colspan="6">Status / Register RES
Channel 0 / Table 0</td><td rowspan="10">2 bytes and 1 word (2 bytes) are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. The word's byte order is depending on the adjusted process data representation. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="4">Input data Channel 0
Byte 1[4] (Byte 0[5])</td><td colspan="4">Register data RD
Table 0, HB[4] (LB[5])</td></tr>
<tr><td colspan="4">Input data Channel 0
Byte 0[4] (Byte 1[5])</td><td colspan="4">Register data RD
Table 0, LB[4] (HB[5])</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /</td></tr>
<tr><td rowspan="5">6</td><td>PD
RA</td><td>RW</td><td colspan="6">Control /Register REQ
Channel 0 / Table 0</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="4">Output data Channel 0
Byte 1[4] (Byte 0[5])</td><td colspan="4">Register data WR
Table 0, HB[4] (LB[5])</td></tr>
<tr><td colspan="4">Output data Channel 0
Byte 0[4] (Byte 1[5])</td><td colspan="4">Register data WR
Table 0, LB[4] (HB[5])</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /</td></tr>
<tr><td></td><td colspan="9">[4] MOTOROLA format
[5] INTEL format</td><td></td></tr>
</table>

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel 0		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
Process data representation		The process data will be transferred
Channel 0	according to device settings*)	• using the format settings of the IO device.
	INTEL (LSB-MSB)	• Little Endian Format
	MOTOROLA (MSB-LSB)	• Big Endian Format
	*) Default settings	

5.3.5.4 SSI Transmitter Interface

PNIO Module type	EA Type	Module type member	PNIO Data type	Instances	
				Input	Output
1SSI	**SSI**	75x-630	Unsigned32	1	-
1SSI, EM	**SSI_EM**		Unsigned8[2] Unsigned32	1	1

PNIO Module type	In-/Outputs									
	Length [Byte]	Bit (Byte) allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
1SSI	4	Input data Channel 0 Byte 3[4] (Byte 0[5])								1 double word (4 bytes) are allocated within the input process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. The double word's byte order is depending on the adjusted process data representation. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Input data Channel 0 Byte 2[4] (Byte 1[5])								
		Input data Channel 0 Byte 1[4] (Byte 2[5])								
		Input data Channel 0 Byte 0[4] (Byte 3[5])								
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
1SSI, EM	6	PD RA	F	Status / Register RES Channel 0 / Table 0						2 bytes and 1 double word (4 bytes) are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. The double word's byte order is depending on the adjusted process data representation. The output data are unused during standard communication. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Input data Channel 0 Byte 3[4] (Byte 0[5])				Register data RD Table 0, LB[5]				
		Input data Channel 0 Byte 2[4] (Byte 1[5])				Register data RD Table 0, HB[5]				
		Input data Channel 0 Byte 1[4] (Byte 2[5])				Register data RD Table 0, HB[4]				
		Input data Channel 0 Byte 0[4] (Byte 3[5])				Register data RD Table 0, LB[4]				
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
	6	PD RA	RW	Control / Register REQ Channel 0 / Table 0						
		Register data RD Table 0, LB[5]								
		Register data RD Table 0, HB[5]								
		Register data RD Table 0, HB[4]								
		Register data RD Table 0, LB[4]								
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
	[4] MOTOROLA format [5] INTEL format									

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel 0		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
Process data representation		The process data will be transferred
Channel 0	according to device settings*)	• using the format settings of the IO device.
	INTEL (LSB-MSB)	• Little Endian Format
	MOTOROLA (MSB-LSB)	• Big Endian Format
	*) Default settings	

5.3.5.5 Incremental Encoder Interfaces

<table>
<tr><th rowspan="2">PNIO Module type</th><th rowspan="2">Module type member</th><th rowspan="2">PNIO Data type</th><th colspan="2">Instances</th></tr>
<tr><th>Input</th><th>Output</th></tr>
<tr><td>1ENC</td><td>75x-631, 75x-634, 75x-637</td><td>Unsigned8
Unsigned16</td><td>2</td><td>2</td></tr>
</table>

<table>
<tr><th rowspan="3">PNIO Module type</th><th colspan="10">In-/Outputs</th></tr>
<tr><th rowspan="2">Length [Byte]</th><th colspan="8">Bit (Byte) allocation</th><th rowspan="2">Note</th></tr>
<tr><th>2^7</th><th>2^6</th><th>2^5</th><th>2^4</th><th>2^3</th><th>2^2</th><th>2^1</th><th>2^0</th></tr>
<tr><td rowspan="14">1ENC</td><td rowspan="7">6</td><td>PD RA</td><td>-</td><td colspan="6">Status 0 / Register RES Channel 0 / Table 0</td><td rowspan="14">2 bytes and 2 words (4 bytes) are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. The words' byte order is depending on the adjusted process data representation. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.</td></tr>
<tr><td colspan="4">Input data Channel 0 Byte 1[4] (Byte 0[5])</td><td colspan="4">Register data RD Table 0, HB[4] (LB[5])</td></tr>
<tr><td colspan="4">Input data Channel 0 Byte 0[4] (Byte 1[5])</td><td colspan="4">Register data RD Table 0, LB[4] (HB[5])</td></tr>
<tr><td colspan="8">Status 1</td></tr>
<tr><td colspan="8">Input data Channel 0 Byte 3[4] (Byte 2[5])</td></tr>
<tr><td colspan="8">Input data Channel 0 Byte 2[4] (Byte 3[5])</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /</td></tr>
<tr><td rowspan="7">6</td><td>PD RA</td><td>RW</td><td colspan="6">Control 0 / Register REQ Channel 0 / Table 0</td></tr>
<tr><td colspan="4">Output data Channel 0 Byte 1[4] (Byte 0[5])</td><td colspan="4">Register data WR Table 0, HB[4] (LB[5])</td></tr>
<tr><td colspan="4">Output data Channel 0 Byte 0[4] (Byte 1[5])</td><td colspan="4">Register data WR Table 0, LB[4] (HB[5])</td></tr>
<tr><td colspan="8">Control 1</td></tr>
<tr><td colspan="8">Output data Channel 0 Byte 3[4] (Byte 2[5])</td></tr>
<tr><td colspan="8">Output data Channel 0 Byte 2[4] (Byte 3[5])</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /</td></tr>
<tr><td></td><td colspan="9">[4] MOTOROLA format
[5] INTEL format</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">General module/channel parameters</th></tr>
<tr><th>Parameter</th><th>Value</th><th>Significance</th></tr>
<tr><td>Asynch. diagnostic message Channel 0[1)]</td><td></td><td>The following occurs per diagnostic data sets and diagnostic alarm with external faults</td></tr>
<tr><td></td><td>disabled[*)]</td><td>• not transferred to the IO controller</td></tr>
<tr><td></td><td>enabled</td><td>• transferred to the IO controller</td></tr>
<tr><td>Process data representation</td><td></td><td>The process data will be transferred</td></tr>
<tr><td>Channel 0</td><td>according to device settings</td><td>• transfer the settings of the IO device</td></tr>
<tr><td></td><td>INTEL (LSB-MSB)</td><td>• Little Endian Format</td></tr>
<tr><td></td><td>MOTOROLA (MSB-LSB)</td><td>• Big Endian Format</td></tr>
<tr><td></td><td colspan="2"></td></tr>
<tr><td></td><td colspan="2">[*)] Default settings</td></tr>
<tr><td></td><td colspan="2">[1)] only with 75x-637</td></tr>
</table>

5.3.5.6 Digital Impulse Interface

<table>
<tr><th rowspan="2">PNIO
Module type</th><th rowspan="2">Module type member</th><th rowspan="2">PNIO Data type</th><th colspan="2">Instances</th></tr>
<tr><th>Input</th><th>Output</th></tr>
<tr><td>1DII</td><td>75x-635</td><td>Unsigned8
Unsigned8[3]</td><td>1</td><td>1</td></tr>
</table>

<table>
<tr><th rowspan="3">PNIO
Module type</th><th colspan="10">In-/Outputs</th></tr>
<tr><th rowspan="2">Length
[Byte]</th><th colspan="8">Bit (Byte) allocation</th><th rowspan="2">Note</th></tr>
<tr><th>2^7</th><th>2^6</th><th>2^5</th><th>2^4</th><th>2^3</th><th>2^2</th><th>2^1</th><th>2^0</th></tr>
<tr><td rowspan="10">1DII</td><td rowspan="5">4</td><td>PD
RA</td><td>F</td><td colspan="6">Status 0 / Register RES
Channel 0 / Table 0</td><td rowspan="10">4 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.</td></tr>
<tr><td colspan="4">Input data
Channel 0 Byte 0</td><td colspan="4">Register data RD
Table 0, LB</td></tr>
<tr><td colspan="4">Input data
Channel 0 Byte 1</td><td colspan="4">Register data RD
Table 0, HB</td></tr>
<tr><td colspan="8">Input data
Channel 0 Byte 2</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /</td></tr>
<tr><td rowspan="5">4</td><td>PD
RA</td><td>RW</td><td colspan="6">Control 0 / Register REQ
Channel 0 / Table 0</td></tr>
<tr><td colspan="4">Output data
Channel 0 Byte 0</td><td colspan="4">Register data WR
Table 0, LB</td></tr>
<tr><td colspan="4">Output data
Channel 0 Byte 1</td><td colspan="4">Register data WR
Table 0, HB</td></tr>
<tr><td colspan="8">Output data
Channel 0 Byte 2</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /</td></tr>
</table>

<table>
<tr><th colspan="3">General module/channel parameters</th></tr>
<tr><th>Parameter</th><th>Value</th><th>Significance</th></tr>
<tr><td>Asynch. diagnostic message
Channel 0</td><td></td><td>The following occurs per diagnostic data sets and diagnostic alarm with external faults</td></tr>
<tr><td></td><td>disabled*)</td><td>• not transferred to the IO controller</td></tr>
<tr><td></td><td>enabled</td><td>• transferred to the IO controller</td></tr>
<tr><td></td><td colspan="2"></td></tr>
<tr><td></td><td colspan="2">*) Default settings</td></tr>
</table>

5.3.5.7 Serial Interfaces

PNIO Module type	Module type member	PNIO Data type	Instances	
			Input	Output
SER_5D	75x-650, 75x-651, 75x-653	Unsigned8 OctetString[5]	1	1
SER_6D	75x-652	Unsigned8[2] OctetString[6]	1	1
SER_22D		Unsigned8[2] OctetString[22]		
SER_46D		Unsigned8[2] OctetString[46]		

PNIO Modul type	In-/Output									
	Length [Byte]	Bit (Byte) allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
SER_5D	6	PD RA	F -	Status 0 / Register RES Channel 0 / Table 0						6, 8, 24 or 48 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with these configuration modules. The data bytes 3 and 4 can be reserved for SER_5D depending on the adjusted operating mode. These modules enable access to the register structure of the I/O module within cyclic data exchange for configuration purposes. For SER_5D this is also denpending on the operating mode. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Input data Channel 0 Byte 0			Status 1 Channel 0		Register data RD Table 0, LB			
		Input data Channel 0 Byte 1			Input data Channel 0 Byte 0		Register data RD Table 1, HB			
		Input data Channel 0 Byte 2				Input data Channel 0 Byte 1				
		Input data Channel 0 Byte 3[1)]				Input data Channel 0 Byte 2				
		Input data Channel 0 Byte 4[1)]				Input data Channel 0 Byte 3				
		. . .								
SER_6D	8	Input data Channel 0 Byte 5								
		. . .								
SER_22D	24	Input data Channel 0 Byte 21								
		. . .								
SER_46D	48	Input data Channel 0 Byte 45								
		\ - - - - - - - - - - - - - - - Input- - - - - - - - - - - - - - - - /								
SER_5D	6	PD RA	RW	Control 0 / Register REQ Channel 0 / Table 0						
		Output data Channel 0 Byte 0			Control 1 Channel 0		Register data WR Table 0, LB			
		Output data Channel 0 Byte 1			Output data Channel 0 Byte 0		Register data WR Table 0, HB			
		Output data Channel 0 Byte 2				Output data Channel 0 Byte 1				
		Output data Channel 0 Byte 3[1)]				Output data Channel 0 Byte 2				
		Output data Channel 0 Byte 4[1)]				Output data Channel 0 Byte 3				
		. . .								
SER_6D	8	Output data Channel 0 Byte 5								
		. . .								
SER_22D	24	Output data Channel 0 Byte 21								
		. . .								
SER_46D	48	Output data Channel 0 Byte 45								
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								
	1) only available for SER_5D in 5-Byte Mode, reserved in 3-Byte Mode									

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel 0		The following occurs per diagnostic data sets and diagnostic alarm when the receiver buffer overfills
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller

Specific module/channel parameters for 75x-652		
Parameter	**Value**	**Significance**
Operating mode		The physical interface works in the operating mode
	RS232	• RS-232 C
	RS485 half-duplex*)	• RS-485 half-duplex
	RS485 full-duplex	• RS-485 full-duplex
Transmission rate/[bit/s]		The characters in the process image are sent or received serially with a transmission rate of
	300	• 300 bit/s
	1200	• 1200 bit/s
	2400	• 2400 bit/s
	4800	• 4800 bit/s
	9600*)	• 9600 bit/s
	19200	• 19200 bit/s
	38400	• 38400 bit/s
	57600	• 57600 bit/s
	115200	• 115200 bit/s
Data bits		A character includes
	8*)	• 8 Bit
	7	• 7 Bit
Parity		The parity bit forms the quality rating
	none*)	• not at all
	odd	• odd
	even	• even
Stop bits		The number of stop bits is
	1*)	• 1 Bit
	2	• 2 Bit
Flow control		The Diagnostic information of the correspond-ing channel is
	none*)	• not at all
	Xon/Xoff	• via Xon/Xoff protocol
	Hardware	• via RTS- and CTS signals
Continuous send mode		The continuous send is
	disabled*)	• OFF
	enabled	• ON
Continuous receive mode		The continuous receive is
	disabled*)	• OFF
	enabled	• ON
Switching time RS485		The switching time in RS-485 mode is
	100 us*)	• 100 us
	2 symbols	• 2 symbol length
	4 symbols	• 4 symbol length
Timeout continuous receive mode		The monitoring time at continuous receive is
	2 symbols*)	• 2 symbol length
	4 symbols	• 4 symbol length
Flank slope RS-485		The flank slope at RS-485 mode is
	low*)	• low
	*) Default setting	

5.3.5.8 Data Exchange Module

PNIO Module type	EA Type	Module type member	PNIO Data type	Instances	
				Input	Output
DXH	**DXH**	75x-654	OctetString[4]	1	1
DXH, EM	**DXH_EM**		Unsigned8 OctetString[5]		

PNIO Module type	In-/Outputs		
	Length [Byte]	Bit (Byte) allocation 2^7 / 2^6 / 2^5 / 2^4 / 2^3 / 2^2 / 2^1 / 2^0	Note
DXH	4	Input data Channel 0 Byte 0 (Byte 1)	4 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Input data Channel 0 Byte 1 (Byte 0)	
		Input data Channel 0 Byte 3 (Byte 4)	
		Input data Channel 0 Byte 4 (Byte 3)	
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /	
	4	Output data Channel 0 Byte 0 (Byte 1)	
		Output data Channel 0 Byte 1 (Byte 0)	
		Output data Channel 0 Byte 3 (Byte 4)	
		Output data Channel 0 Byte 4 (Byte 3)	
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /	
DXH, EM	6	PD RA / - / Status 0 / Register RES Channel 0 / Table 0	6 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Input data Channel 0 Byte 0 / Register data RD Table 0, LB	
		Input data Channel 0 Byte 1 / Register data RD Table 1, HB	
		Input data Channel 0 Byte 2	
		Input data Channel 0 Byte 3	
		Input data Channel 0 Byte 4	
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /	
	6	PD RA / RW / Control 0 / Register REQ Channel 0 / Table 0	
		Output data Channel 0 Byte 0 / Register data WR Tab. 0, HB4) (LB5))	
		Output data Channel 0 Byte 1 / Register data WR Tab. 0, LB4) (HB5))	
		Output data Channel 0 Byte 2	
		Output data Channel 0 Byte 3	
		Output data Channel 0 Byte 4	
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /	

General module/channel parameters		
Parameter	**Value**	**Significance**

5.3.5.9 KNX/EIB/TP1 Module

PNIO Module type	EA Type	Module type member	PNIO Data type	Instances	
				Input	Output
KNX, EM	KNX_EM	75x-646	Unsigned8[2], Unsigned8[22]	1	1

PNIO Modul type	In-/Outputs									
	Length [Byte]	Bit (Byte) allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
KNX, EM	24	PD RA	F 0	Status 0 / Register RES Channel 0 / Table 0						24 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		K2C_DRD				Register data RD Table 0, LB				
		Status 1				Register data RD Table 1, HB				
		Relevant length DPT text in Byte								
		RAM Flags								
		IEC address Byte 0								
		…								
		IEC address Byte 3								
		DPT text Byte 0								
		…								
		DPT text Byte 13								
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
	24	PD RA	RW	Control 0 / Register REQ Channel 0 / Table 0						
		C2K_DWR				Register data WR Table 0, LB				
		Control 1				Register data WR Table 1, HB				
		Relevant length DPT text in Byte								
		RAM Flags								
		IEC address Byte 0								
		…								
		IEC address Byte 3								
		DPT text Byte 0								
		…								
		DPT text Byte 13								
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								

General module/channel parameters		
Parameter	**Value**	**Significance**

5.3.5.10 DALI/DSI Master Module

<table>
<tr><th rowspan="2">PNIO Module type</th><th rowspan="2">Module type member</th><th rowspan="2">PNIO Data type</th><th colspan="2">Instances</th></tr>
<tr><th>Input</th><th>Output</th></tr>
<tr><td>DALI/DSI</td><td>75x-641</td><td>Unsigned8
OctetString[5]</td><td>1</td><td>1</td></tr>
</table>

<table>
<tr><th rowspan="3">PNIO Module type</th><th colspan="10">In-/Outputs</th></tr>
<tr><th rowspan="2">Length [Byte]</th><th colspan="8">Bit (Byte) allocation</th><th rowspan="2">Note</th></tr>
<tr><th>2^7</th><th>2^6</th><th>2^5</th><th>2^4</th><th>2^3</th><th>2^2</th><th>2^1</th><th>2^0</th></tr>
<tr><td rowspan="14">DALI/DSI</td><td rowspan="7">6</td><td>PD
RA</td><td>-</td><td colspan="6">Status 0 / Register RES
Channel 0 / Table 0</td><td rowspan="14">6 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.</td></tr>
<tr><td colspan="4">Input data
Channel 0 Byte 0</td><td colspan="4">Register data RD
Table 0, LB</td></tr>
<tr><td colspan="4">Input data
Channel 0 Byte 1</td><td colspan="4">Register data RD
Table 1, HB</td></tr>
<tr><td colspan="8">Input data
Channel 0 Byte 2</td></tr>
<tr><td colspan="8">Input data
Channel 0 Byte 3</td></tr>
<tr><td colspan="8">Input data
Channel 0 Byte 4</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /</td></tr>
<tr><td rowspan="7">6</td><td>PD
RA</td><td>RW</td><td colspan="6">Control 0 / Register REQ
Channel 0 / Table 0</td></tr>
<tr><td colspan="4">Output data
Channel 0 Byte 0</td><td colspan="4">Register data WR
Table 0, LB</td></tr>
<tr><td colspan="4">Output data
Channel 0 Byte 1</td><td colspan="4">Register data WR
Table 1, HB</td></tr>
<tr><td colspan="8">Output data
Channel 0 Byte 2</td></tr>
<tr><td colspan="8">Output data
Channel 0 Byte 3</td></tr>
<tr><td colspan="8">Output data
Channel 0 Byte 4</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /</td></tr>
</table>

<table>
<tr><th colspan="3">General module/channel parameters</th></tr>
<tr><th>Parameter</th><th>Value</th><th>Significance</th></tr>
<tr><td>Asynch. diagnostic message
Channel 0</td><td></td><td>The following occurs per diagnostic data sets and diagnostic alarm with external faults</td></tr>
<tr><td></td><td>disabled*)</td><td>• not transferred to the IO controller</td></tr>
<tr><td></td><td>enabled</td><td>• transferred to the IO controller</td></tr>
<tr><td></td><td colspan="2"></td></tr>
<tr><td></td><td colspan="2">*) Default settings</td></tr>
</table>

5.3.5.11 AS-Interface Master

PNIO Module Type	Module type member	PNIO-Data type	Instances	
			Input	Output
ASI_10D	75x-655	Unsigned8[2] OctetString[10]	1	1
ASI_18D		Unsigned8[2] OctetString[18]		
ASI_22D		Unsigned8[2] OctetString[22]		
ASI_30D		Unsigned8[2] OctetString[30]		
ASI_38D		Unsigned8[2] OctetString[38]		
ASI_46D		Unsigned8[2] OctetString[46]		

PNIO Module type	In-/Outputs									
	Length [Byte]	Bit (Byte) allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
		PD RA	F 0	Status 0 / Register RES Channel 0 / Table 0						12, 20, 24, 32, 40 or 48 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with these configuration modules. They enable access to the register structure of the I/O module within cyclic data exchange for configuration purposes. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for thess modules.
		Receive data Mailbox Byte 0				Register data RD Table 0, LB				
		Receive data Mailbox Byte 1				Register data RD Table 1, HB				
		Receive data Mailbox Byte 2								
		Receive data Mailbox Byte 3								
		Receive data Mailbox Byte 4								
		Receive data Mailbox Byte 5								
		Input data ASi-Master Flags				Input data ASi-Slave 1/1A				
		Input data ASi-Slave 2/2A				Input data ASi-Slave 3/3A				
		...				...				
ASI_10D	12	Input data ASi-Slave 6/6A				Input data ASi-Slave 7/7A				
		...				...				
ASI_18D	20	Input data ASi-Slave 22/22A				Input data ASi-Slave 23/23A				
		...				...				
ASI_22D	24	Input data ASi-Slave 30/30A				Input data ASi-Slave 31/31A				
		...				...				
ASI_30D	32	Input data ASi-Slave 14B				Input data ASi-Slave 15B				
		...				...				
ASI_38D	40	Input data ASi-Slave 30B				Input data ASi-Slave 31B				
		...				...				
ASI_46D	48	Input data ---				Input data ---				
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								

PNIO Module type	In-/Outputs									
	Length [Byte]	Bit (Byte) allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
		PD RA	RW	Control 0 / Register REQ Channel 0 / Table 0						
		Send data Mailbox Byte 0				Register data WR Table 0, LB				
		Send data Mailbox Byte 1				Register data WR Table 1, HB				
		Send data Mailbox Byte 2								
		Send data Mailbox Byte 3								
		Send data Mailbox Byte 4								
		Send data Mailbox Byte 5								
		Output data ASi-Master Flags				Output data ASi-Slave 1/1A				
		Output data ASi-Slave 2/2A				Output data ASi-Slave 3/3A				
		...				...				
ASI_10D	12	Output data ASi-Slave 5/5A				Output data ASi-Slave 6/6A				
		...				...				
ASI_18D	20	Output data ASi-Slave 22/22A				Output data ASi-Slave 23/23A				
		...				...				
ASI_22D	24	Output data ASi-Slave 30/30A				Output data ASi-Slave 31/31A				
		...				...				
ASI_30D	32	Output data ASi-Slave 14B				Output data ASi-Slave 15B				
		...				...				
ASI_38D	40	Output data ASi-Slave 30B				Output data ASi-Slave 31B				
		...				...				
ASI_46D	48	Output data ---				Output data ---				
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel 0		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller

Specific module/channel parameters		
Parameter	**Value**	**Significance**
Mailbox lenght		The data length of the mailbox in the input and output process image is
	No mailbox	• 0 byte
	6 bytes	• 6 byte
	10 bytes	• 10 byte
	12 bytes	• 12 byte
	18 bytes	• 18 byte
Cross-fading of mailbox		The mailbox is
	disabled*)	• not shown via the process image
	enabled	• if necessary, shown via the process image.
	*) Default settings	

5.3.5.12 Radio Receiver Module

PNIO Module type	Module type member	PNIO-Data type	Instances	
			Input	Output
EnOcean	75x-642	Unsigned8, OctetString[3]	1	1

<table>
<tr><th rowspan="3">PNIO Module type</th><th colspan="10">In-/Outputs</th></tr>
<tr><th rowspan="2">Length [Byte]</th><th colspan="8">Bit (Byte) allocation</th><th rowspan="2">Note</th></tr>
<tr><th>2^7</th><th>2^6</th><th>2^5</th><th>2^4</th><th>2^3</th><th>2^2</th><th>2^1</th><th>2^0</th></tr>
<tr><td rowspan="10">EnOcean</td><td rowspan="5">4</td><td>PD RA</td><td>F</td><td colspan="6">Status 0 / Register RES Channel 0 / Table 0</td><td rowspan="10">4 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.</td></tr>
<tr><td colspan="4">Input data Channel 0 Byte 0</td><td colspan="4">Register data RD Table 0, LB</td></tr>
<tr><td colspan="4">Input data Channel 0 Byte 1</td><td colspan="4">Register data RD Table 1, HB</td></tr>
<tr><td colspan="8">Input data Channel 0 Byte 2</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /</td></tr>
<tr><td rowspan="5">4</td><td>PD RA</td><td>RW</td><td colspan="6">Control 0 / Register REQ Channel 0 / Table 0</td></tr>
<tr><td colspan="4">Output data Channel 0 Byte 0</td><td colspan="4">Register data WR Table 0, LB</td></tr>
<tr><td colspan="4">Output data Channel 0 Byte 1</td><td colspan="4">Register data WR Table 1, HB</td></tr>
<tr><td colspan="8">Output data Channel 0 Byte 2</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /</td></tr>
</table>

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel 0		The following occurs per diagnostic data sets and diagnostic alarm when the receiver buffer overfills
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
	*) Default settings	

5.3.5.13 *Bluetooth®* / RF-Transceiver

PNIO Module type	Module type member	PNIO-Data type	Instances	
			Input	Output
BT_10D	750-644	Unsigned8[2] OctetString[10]	1	1
BT_22D		Unsigned8[2] OctetString[22]		
BT_46D		Unsigned8[2] OctetString[46]		

<table>
<tr><th rowspan="3">PNIO
Module type</th><th colspan="10">In-/Outputs</th></tr>
<tr><th rowspan="2">Length
[Byte]</th><th colspan="8">Bit (Byte) allocation</th><th rowspan="2">Note</th></tr>
<tr><th>2^7</th><th>2^6</th><th>2^5</th><th>2^4</th><th>2^3</th><th>2^2</th><th>2^1</th><th>2^0</th></tr>
<tr><td rowspan="12">BT_10D</td><td rowspan="12">12</td><td>PD
RA</td><td>-</td><td colspan="6">Status 0 / Register RES
Channel 0 / Table 0</td><td rowspan="34">12, 24 or 48 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with these configuration modules. They enable access to the register structure of the I/O module within cyclic data exchange for configuration purposes. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="3">Input data
Byte 0</td><td colspan="2">Receive data
Mailbox Byte 0</td><td colspan="3">Register data RD
Table 0, LB</td></tr>
<tr><td colspan="3">Input data
Byte 1</td><td colspan="2">Receive data
Mailbox Byte 1</td><td colspan="3">Register data RD
Table 0, HB</td></tr>
<tr><td colspan="4">Input data
Byte 2</td><td colspan="4">Receive data
Mailbox Byte 2</td></tr>
<tr><td colspan="4">Input data
Byte 3</td><td colspan="4">Receive data
Mailbox Byte 3</td></tr>
<tr><td colspan="4">Input data
Byte 4</td><td colspan="4">Receive data
Mailbox Byte 4</td></tr>
<tr><td colspan="4">Input data
Byte 5</td><td colspan="4">Receive data
Mailbox Byte 5</td></tr>
<tr><td colspan="8">Input data Byte 6</td></tr>
<tr><td colspan="8">Input data Byte 7</td></tr>
<tr><td colspan="8">Input data Byte 8</td></tr>
<tr><td colspan="8">Input data Byte 9</td></tr>
<tr><td rowspan="2">BT_22D</td><td rowspan="2">24</td><td colspan="8">...</td></tr>
<tr><td colspan="8">Input data Byte 21</td></tr>
<tr><td rowspan="2">BT_46D</td><td rowspan="2">48</td><td colspan="8">...</td></tr>
<tr><td colspan="8">Input data Byte 45</td></tr>
<tr><td></td><td></td><td colspan="8">\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /</td></tr>
<tr><td rowspan="12">BT_10D</td><td rowspan="12">12</td><td>PD
RA</td><td>RW</td><td colspan="6">Control 0 / Register REQ
Channel 0 / Table 0</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="3">Output data
Byte 0</td><td colspan="2">Send data
Mailbox Byte 0</td><td colspan="3">Registerdata WR
Table 0, LB</td></tr>
<tr><td colspan="3">Output data
Byte 1</td><td colspan="2">Send data
Mailbox Byte 1</td><td colspan="3">Registerdata WR
Table 1, HB</td></tr>
<tr><td colspan="4">Output data
Byte 2</td><td colspan="4">Send data
Mailbox Byte 2</td></tr>
<tr><td colspan="4">Output data
Byte 3</td><td colspan="4">Send data
Mailbox Byte 3</td></tr>
<tr><td colspan="4">Output data
Byte 4</td><td colspan="4">Send data
Mailbox Byte 4</td></tr>
<tr><td colspan="4">Output data
Byte 5</td><td colspan="4">Send data
Mailbox Byte 5</td></tr>
<tr><td colspan="8">Output data Byte 6</td></tr>
<tr><td colspan="8">Output data Byte 7</td></tr>
<tr><td colspan="8">Output data Byte 8</td></tr>
<tr><td colspan="8">Output data Byte 9</td></tr>
<tr><td rowspan="2">BT_22D</td><td rowspan="2">24</td><td colspan="8">...</td></tr>
<tr><td colspan="8">Output data Byte 21</td></tr>
<tr><td rowspan="2">BT_46D</td><td rowspan="2">48</td><td colspan="8">...</td></tr>
<tr><td colspan="8">Output data Byte 45</td></tr>
<tr><td></td><td></td><td colspan="8">\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /</td></tr>
</table>

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel 0		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller

Specific module/channel parameters		
Parameter	**Value**	**Significance**
Mailbox length		The data length of the mailbox in the input and output process image is
	6 Byte*)	• 6 Byte
	12 Byte1)	• 12 Byte
	18 Byte1)	• 18 Byte
	*) Default settings	
	1) only for BT_22D and BT_46D	

5.3.5.14 MP-Bus Master Module

PNIO Module type	Module type member	PNIO-Data type	Instances	
			Input	Output
MP_BUS	75x-643	Unsigned8[2] OctetString[6]	1	1

<table>
<tr><th rowspan="3">PNIO
Module type</th><th colspan="10">In-/Outputs</th></tr>
<tr><th rowspan="2">Length
[Byte]</th><th colspan="8">Bit (Byte) allocation</th><th rowspan="2">Note</th></tr>
<tr><th>2^7</th><th>2^6</th><th>2^5</th><th>2^4</th><th>2^3</th><th>2^2</th><th>2^1</th><th>2^0</th></tr>
<tr><td rowspan="20">MP_BUS</td><td rowspan="10">8</td><td>PD
RA</td><td>F
0</td><td colspan="6">Status 0 / Register RES
Channel 0 / Table 0</td><td rowspan="20">8 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.</td></tr>
<tr><td colspan="4">Status 1</td><td colspan="4">Register data RD
Table 0, LB</td></tr>
<tr><td colspan="4">Input data
Byte 0</td><td colspan="4">Register data RD
Table 1, HB</td></tr>
<tr><td colspan="8">Input data Byte 1</td></tr>
<tr><td colspan="8">Input data Byte 2</td></tr>
<tr><td colspan="8">Input data Byte 3</td></tr>
<tr><td colspan="8">Input data Byte 4</td></tr>
<tr><td colspan="8">Input data Byte 5</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td rowspan="10">8</td><td>PD
RA</td><td>RW</td><td colspan="6">Control 0 / Register REQ
Channel 0 / Table 0</td></tr>
<tr><td colspan="4">Control 1</td><td colspan="4">Register data WR
Table 0, LB</td></tr>
<tr><td colspan="4">Output data
Byte 0</td><td colspan="4">Register data WR
Table 1, HB</td></tr>
<tr><td colspan="8">Output data Byte 1</td></tr>
<tr><td colspan="8">Output data Byte 2</td></tr>
<tr><td colspan="8">Output data Byte 3</td></tr>
<tr><td colspan="8">Output data Byte 4</td></tr>
<tr><td colspan="8">Output data Byte 5</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /</td></tr>
<tr><td colspan="8"></td></tr>
</table>

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel 0		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
	*) Default settings	

5.3.5.15 2-Channel Vibration Velocity / Bearing Condition Monitoring VIB I/O

PNIO Module type	Module type member	PNIO-Data type	Instances	
			Input	Output
VIB_IO	75x-645	Unsigned8 Unsigned16	4	4

PNIO Module type	In-/Outputs				
	Lenth [Byte]	Bit (Byte) allocation (2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0)			Note
VIB_IO	12	PD RA	0	Status 0 / Register RES Channel 0 / Table 0	12 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. The words' byte order is depending on the adjusted process data representation. The output data are unused during standard communication.Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		RMS vibration velocity Channel 0 HB[4] (LB[5])		Register data RD Table 0, HB[4] (LB[5])	
		RMS vibration velocity Channel 0 LB[4] (HB[5])		Register data RD Table 0, LB[4] (HB[5])	
		PD RA	0	Status 1 / Register RES Channel 1 / Table 1	
		RMS vibration velocity Channel 1 HB[4] (LB[5])		Register data RD Table 1, HB[4] (LB[5])	
		RMS vibration velocity Channel 1 LB[4] (HB[5])		Register data RD Table 1, LB[4] (HB[5])	
		PD RA	0	Status 2 / Register RES Channel 2 / Table 2	
		SPM Channel 0 Carpet[4] (Peak[5])		Register data RD Table 2, HB[4] (LB[5])	
		SPM Channel 0 Peak[4] (Carpet[5])		Register data RD Table 2, LB[4] (HB[5])	
		PD RA	0	Status 3 / Register RES Channel 3 / Table 3	
		SPM Channel 1 Carpet[4] (Peak[5])		Register data RD Table 3, HB[4] (LB[5])	
		SPM Channel 1 Peak[4] (Carpet[5])		Register data RD Table 3, LB[4] (HB[5])	
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /			
	12	PD RA	RW	Control 0 / Register REQ Channel 0 / Table 0	
		Register data WR Table 0, HB[4] (LB[5])			
		Register data WR Table 0, LB[4] (HB[5])			
		PD RA	RW	Control 1 / Register REQ Channel 1 / Table 1	
		Register data WR Table 1, HB[4] (LB[5])			
		Register data WR Table 1, LB[4] (HB[5])			
		PD RA	RW	Control 2 / Register REQ Channel 2 / Table 2	
		Register data WR Table 2, HB[4] (LB[5])			
		Register data WR Table 2, LB[4] (HB[5])			
		PD RA	RW	Control 3 / Register REQ Channel 3 / Table 0	
		Register data WR Table 3, HB[4] (LB[5])			
		Register data WR Table 3, LB[4] (HB[5])			
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /			
		[4] MOTOROLA format [5] INTEL format			

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel x (x = 0 ... 3)		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
Process data representation Channel x (x = 0 ... 3)		The process data will be transferred
	according to device settings*)	• transfer the settings of the IO device.
	INTEL (LSB-MSB)	• Little Endian format
	MOTOROLA (MSB-LSB)	• Big Endian format
	*) Default settings	

5.3.5.16 Safety Modules PROFIsafe

PNIO Module type	Module type member	PNIO Data type	Instances	
			Input	Output
PSAFE	753-662/000-002, 753-667/000-002, 75x-661/000-003, 75x-662/000-003, 75x-666/000-003, 75x-667/000-003	OctetString[5]	1	1
PSAFE_iPar	75x-661/000-003, 75x-662/000-003, 75x-666/000-003, 75x-667/000-003			

PNIO Module type	In-/Outputs									
	Length [Byte]	Bit (Byte) allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
PSAFE, PSAFE_iPar	5	I7²⁾	I6²⁾	I5²⁾	I4²⁾	I3	I2	I1	I0	6 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with these configuration modules. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
		F-Status								
		F-Device-CRC Byte 0								
		F- Device -CRC Byte 1								
		F- Device -CRC Byte 2								
		\ - - - - - - - - - - - - - Input - - - - - - - - - - - - - /								
	5	-	-	-	-	O3	O2	O1	O0	
		F-Control								
		F-Host-CRC Byte 0								
		F-Host-CRC Byte 1								
		F-Host-CRC Byte 2								
		\ - - - - - - - - - - - - - Output - - - - - - - - - - - - - /								
	[2] only available for 8-Channel F-Input modules									

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled[1]	• not transferred to the IO controller
	enabled[2]	• transferred to the IO controller
	[1] Default setting for PSAFE module [2] Default setting for PSAFE_iPar modules	

General module/channel parameters (F-Parameters)		
F-Parameter	**Value**	**Significance**
F_Check_iPar		Within the F-Parameters structure manufacturer-specific iParameters can be, those
	NoCheck1)	• not for the check to be consulted
	Check	• for the check to be consulted
F_SIL		The attainable safety category is
	SIL31)	SIL 3
F_CRC_Length		The length of the CRC for the protection of the process data is
	3-Byte-CRC1)	3 bytes
F_Par_Version		The version of the F-parameter set is
	11)	1 = V2-mode
F_Source_Add		PROFIsafe address of the F-Host
	1 …65534	
F_Dest_Add		PROFIsafe address of the bus module (F-Slave)
	1 … 1023 (655342))	
F_WD_Time		Watchdog time of F-data exchange in ms
	50 ... 150*) ... 10000	
F_iPar_CRC3)	0*) ... 4294967295	
	*) Default settings	
	1) not changeable setting	
	2) for 75x-66x/000-003 via software	
	3) for 75x-66x/000-003 using iParameter server	

5.3.5.17 RTC Module

PNIO Module type	Module type member	PNIO-Data type	Instances	
			Input	Output
RTC	75x-640	Unsigned8 OctetString[5]	1	1

<table>
<tr><th rowspan="3">PNIO
Module type</th><th colspan="10">In-/Outputs</th></tr>
<tr><th rowspan="2">Length
[Byte]</th><th colspan="8">Bit (Byte) allocation</th><th rowspan="2">Note</th></tr>
<tr><th>2^7</th><th>2^6</th><th>2^5</th><th>2^4</th><th>2^3</th><th>2^2</th><th>2^1</th><th>2^0</th></tr>
<tr><td rowspan="14">RTC</td><td rowspan="7">6</td><td>PD
RA</td><td>0</td><td colspan="6">Status 0 / Register RES
Channel 0 / Table 0</td><td rowspan="14">8 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.</td></tr>
<tr><td colspan="4">Opcode (mirrored)</td><td colspan="4">Register data RD
Table 0, LB</td></tr>
<tr><td colspan="4">Response parameter
Byte 0</td><td colspan="4">Register data RD
Table 1, HB</td></tr>
<tr><td colspan="8">Response parameter Byte 1</td></tr>
<tr><td colspan="8">Response parameter Byte 2</td></tr>
<tr><td colspan="8">Response parameter Byte 3</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /</td></tr>
<tr><td rowspan="7">6</td><td>PD
RA</td><td>RW</td><td colspan="6">Control 0 / Register REQ
Channel 0 / Table 0</td></tr>
<tr><td colspan="4">Control 1</td><td colspan="4">Register data WR
Table 0, LB</td></tr>
<tr><td colspan="4">Call parameter
Byte 0</td><td colspan="4">Register data WR
Table 1, HB</td></tr>
<tr><td colspan="8">Call parameter Byte 1</td></tr>
<tr><td colspan="8">Call parameter Byte 2</td></tr>
<tr><td colspan="8">Call parameter Byte 3</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /</td></tr>
</table>

General module/channel parameters		
Parameter	**Value**	**Significance**

5.3.5.18 Stepper Controller

PNIO Module type	Module type member	PNIO-Data type	Instances	
			Input	Output
STEPPER	75x-670, 75x-671, 750-672, 750-673	Unsigned8[2] OctetString[10]	1	1

PNIO Module type	In-/Outputs									
	Length [Byte]	Bit (Byte) allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
STEPPER	12	PD RA	F 0	Status 0 / Register RES Channel 0 / Table 0						12 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
		Input data Byte 0			Receive data Mailbox Byte 0			Register data RD Table 0, LB		
		Input data Byte 1			Receive data Mailbox Byte 1			Register data RD Table 0, HB		
		Input data Byte 2				Receive data Mailbox Byte 2				
		Input data Byte 3				Receive data Mailbox Byte 3				
		Input data Byte 4				Receive data Mailbox Byte 4				
		Input data Byte 5				Receive data Mailbox Byte 5				
		Input data Byte 6				reserved				
		Status 3								
		Status 2								
		Status 1								
		\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /								
	12	PD RA	RW	Control 0 / Register REQ Channel 0 / Table 0						
		Output data Byte 0			Send data Mailbox Byte 0			Register data WR Table 0, LB		
		Output data Byte 1			Send data Mailbox Byte 1			Register data WR Table 1, HB		
		Output data Byte 2				Send data Mailbox Byte 2				
		Output data Byte 3				Send data Mailbox Byte 3				
		Output data Byte 4				Send data Mailbox Byte 4				
		Output data Byte 5				Send data Mailbox Byte 5				
		Output data Byte 6				reserved				
		Control 3								
		Control 2								
		Control 1								
		\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /								

General module/channel parameters		
Parameter	**Value**	**Significance**

5.3.5.19 DC-Drive Controller

PNIO Module type	Module type member	PNIO-Data type	Instances	
			Input	Output
DC_DRIVE	75x-636	Unsigned8[2] Unsigned32	1	1

<table>
<tr><th rowspan="3">PNIO
Module type</th><th colspan="10">In-/Output</th></tr>
<tr><th rowspan="2">Length
[Byte]</th><th colspan="8">Bit (Byte) allocation</th><th rowspan="2">Note</th></tr>
<tr><th>2^7</th><th>2^6</th><th>2^5</th><th>2^4</th><th>2^3</th><th>2^2</th><th>2^1</th><th>2^0</th></tr>
<tr><td rowspan="14">DC_DRIVE</td><td rowspan="7">6</td><td>PD
RA</td><td>F
0</td><td colspan="6">Status 0 / Register RES
Channel 0 / Table 0</td><td rowspan="14">6 bytes are allocated within the input and output process image of the station proxy (fieldbus coupler) and are assigned to the physical I/O module by assembling a slot with this configuration module. It enables access to the register structure of the I/O module within cyclic data exchange for configuration purposes. Two bytes process data qualifier (IOCS, IOPS) are managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.</td></tr>
<tr><td colspan="4">Status 1</td><td colspan="4">Register data RD
Table 0, LB</td></tr>
<tr><td colspan="3">Actual position
Byte 0</td><td colspan="2">Status 2</td><td colspan="3">Register data RD
Table 1, HB</td></tr>
<tr><td colspan="4">Actual position
Byte 1</td><td colspan="4">Status 3</td></tr>
<tr><td colspan="4">Actual position
Byte 2</td><td colspan="4">Status 4</td></tr>
<tr><td colspan="4">Actual position
Byte 3</td><td colspan="4">Status 5</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Input - - - - - - - - - - - - - - /</td></tr>
<tr><td rowspan="7">6</td><td>PD
RA</td><td>RW</td><td colspan="6">Control 0 / Register REQ
Channel 0 / Table 0</td></tr>
<tr><td colspan="4">Control 1</td><td colspan="4">Register data WR
Table 0, LB</td></tr>
<tr><td colspan="4">Setpoint position
Byte 0</td><td colspan="4">Register data WR
Table 1, HB</td></tr>
<tr><td colspan="8">Setpoint position Byte 1</td></tr>
<tr><td colspan="8">Setpoint position Byte 2</td></tr>
<tr><td colspan="8">Setpoint position Byte 3</td></tr>
<tr><td colspan="8">\ - - - - - - - - - - - - - - Output - - - - - - - - - - - - - - /</td></tr>
</table>

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel 0		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
	*) Default settings	

5.3.6 System Modules

5.3.6.1 Power Supply Modules

PNIO Module type	IO Type	Module type member	PNIO Data type	Instances	
				Input	Output
2DIA	**DIA_0**	750-606, 75x-610, 75x-611	-	-	-
2 DIA(+6 BIT I), DIA in I-PI	**PE_DIA_8**		Unsigned8 Bitfield	1	-
2DIA(+14 BIT I), DIA in I-PI	**PE_DIA_16**		Unsigned16 Bitfield		
2DIA(+30 BIT I), DIA in I-PI	**PE_DIA_32**		Unsigned32 Bitfield		
*** 2DIA(-2 BIT I), DIA in I-PI**	**PE_DIA_0**	750-606*, 75x-610*, 75x-611*	-	-	-

PNIO Module type	Inputs									
	Length [Bit]	Bit allocation								Note
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
2DIA(+6 BIT I), DIA in I-PI **2DIA(+14 BIT I), DIA in I-PI** **2DIA(+30 BIT I), DIA in I-PI**	2							D0		8, 16 or 32 bits are allocated within the input process image of the station proxy (fieldbus coupler) by assembling a slot with these configuration modules. The bits 2^0 and 2^1 are assigned to the diagnostic states of the physically connected power supply module. The bits marked green are made available for the input and/or diagnostic states of the following module slots. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for these modules.
*** 2DIA(-2 BIT I), DIA in I-PI**	2					D0				The assembling of slots with this configuration module enables the remaining bit locations previously allocated in the input process image by configuration modules without a star to be assigned to the signal states of the physically connected power supply module. The bit locations marked in a light red color are respectively occupied by previous slot allocations. One byte process data qualifier (IOPS) is managed in direction to the IO controller in the cyclic PROFINET IO telegram for this module.
				D0						
		...								
		D0								

General module/channel parameters		
Parameter	**Value**	**Significance**
Asynch. diagnostic message Channel 0		The following occurs per diagnostic data sets and diagnostic alarm with external faults
	disabled*)	• not transferred to the IO controller
	enabled	• transferred to the IO controller
	*) Default settings	

6 Use in Hazardous Environments

The **WAGO-I/O-SYSTEM 750** (electrical equipment) is designed for use in Zone 2 hazardous areas.

The following sections include both the general identification of components (devices) and the installation regulations to be observed. The individual subsections of the "Installation Regulations" section must be taken into account if the I/O module has the required approval or is subject to the range of application of the ATEX directive.

6.1 Marking Configuration Examples

6.1.1 Marking for Europe according to CENELEC and IEC

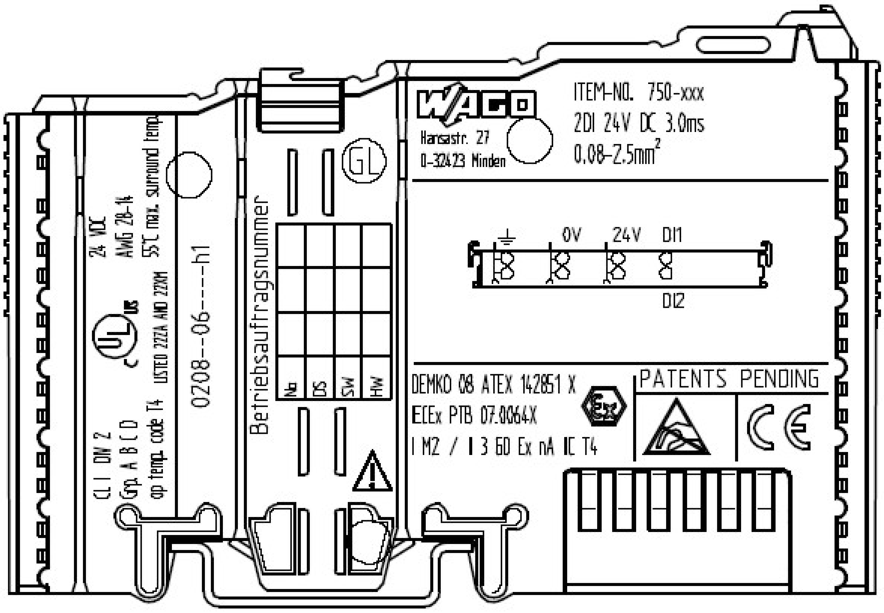


Figure 1: Side marking example for ATEX and IEC Ex approved I/O modules according to CENELEC and IEC

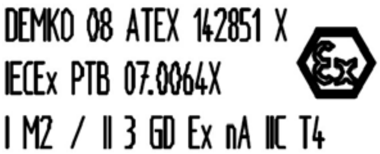


Figure 2: Printing Text detail – Marking example for ATEX and IEC Ex approved I/O modules according to CENELEC and IEC

Table 1: Description of marking example for ATEX and IEC Ex approved I/O modules according to CENELEC and IEC

Printing on Text	Description
DEMKO 08 ATEX 142851 X IECEx PTB 07.0064X	Approval body and/or number of the examination certificate
I M2 / II 3 GD	Explosion protection group and Unit category
Ex nA	Type of ignition and extended identification
IIC	Explosion protection group
T4	Temperature class

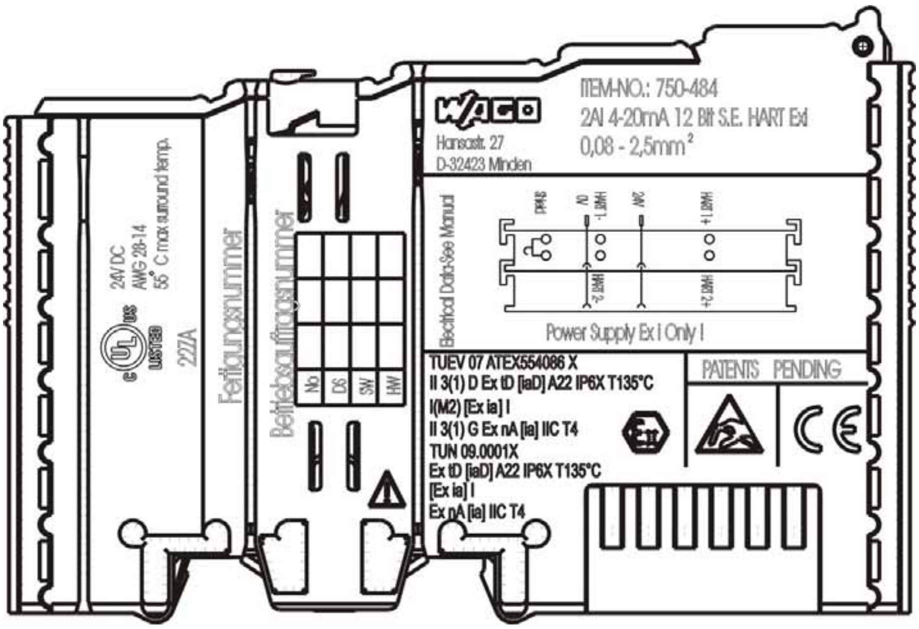


Figure 3: Side marking example for Ex i and IEC Ex i approved I/O modules according to CENELEC and IEC

TUEV 07 ATEX554086 X
II 3(1) D Ex tD [iaD] A22 IP6X T135°C
I(M2) [Ex ia] I
II 3(1) G Ex nA [ia] IIC T4
TUN 09.0001X
Ex tD [iaD] A22 IP6X T135°C
[Ex ia] I
Ex nA [ia] IIC T4

Figure 4: Text detail – Marking example for Ex i and IEC Ex i approved I/O modules according to CENELEC and IEC

Table 2: Description of marking example for Ex i and IEC Ex i approved I/O modules according to CENELEC and IEC

Inscription text	Description
TÜV 07 ATEX 554086 X TUN 09.0001X	Approving authority or certificate numbers
Dust	
II	Device group: All except mining
3(1)D	Device category: Zone 22 device (Zone 20 subunit)
Ex	Explosion protection mark
tD	Protection by enclosure
[iaD]	Approved in accordance with "Dust intrinsic safety" standard
A22	Surface temperature determined according to Procedure A, use in Zone 22
IP6X	Dust-tight (totally protected against dust)
T 135°C	Max. surface temp. of the enclosure (no dust bin)
Mining	
I	Device group: Mining
(M2)	Device category: High degree of safety
[Ex ia]	Explosion protection: Mark with category of type of protection intrinsic safety: Even safe when two errors occur
I	Device group: Mining
Gases	
II	Device group: All except mining
3(1)G	Device category: Zone 2 device (Zone 0 subunit)
Ex	Explosion protection mark
nA	Type of protection: Non-sparking operating equipment
[ia]	Category of type of protection intrinsic safety: Even safe when two errors occur
IIC	Explosion Group
T4	Temperature class: Max. surface temperature 135°C

6.1.2 Marking for America according to NEC 500

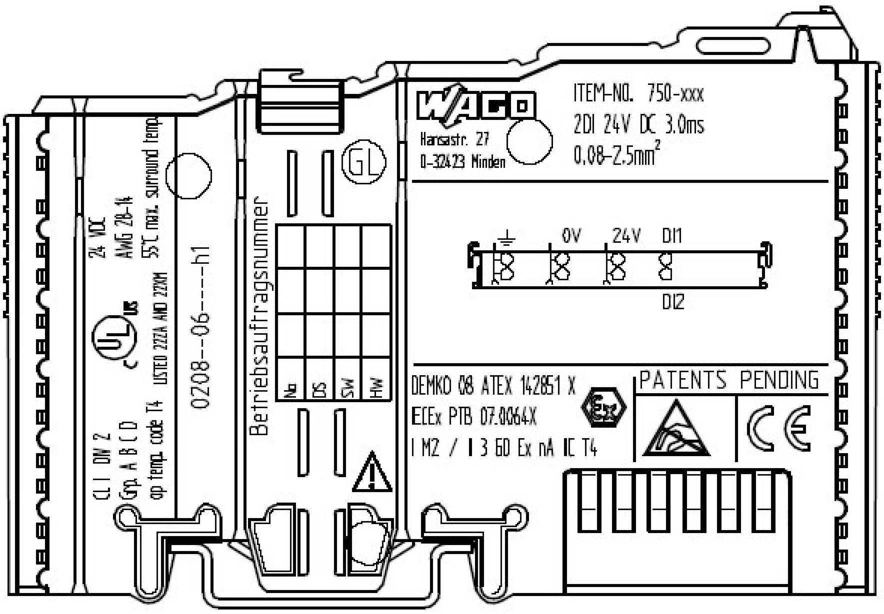


Figure 5: Side marking example for I/O modules according to NEC 500

Figure 6: Text detail – Marking example for I/O modules according to NEC 500

Table 3: Description of marking example for I/O modules according to NEC 500

Printing on Text	Description
CL 1	Explosion protection group (condition of use category)
DIV 2	Area of application (zone)
Grp. ABCD	Explosion group (gas group)
Optemp code T4	Temperature class

6.2 Installation Regulations

In the **Federal Republic of Germany**, various national regulations for the installation in explosive areas must be taken into consideration. The basis for this forms the working reliability regulation, which is the national conversion of the European guideline 99/92/E6. They are complemented by the installation regulation EN 60079-14. The following are excerpts from additional VDE regulations:

Table 4: VDE Installation Regulations in Germany

DIN VDE 0100	Installation in power plants with rated voltages up to 1000 V
DIN VDE 0101	Installation in power plants with rated voltages above 1 kV
DIN VDE 0800	Installation and operation in telecommunication plants including information processing equipment
DIN VDE 0185	lightning protection systems

The **USA** and **Canada** have their own regulations. The following are excerpts from these regulations:

Table 5: Installation Regulations in USA and Canada

NFPA 70	National Electrical Code Art. 500 Hazardous Locations
ANSI/ISA-RP 12.6-1987	Recommended Practice
C22.1	Canadian Electrical Code

NOTICE

Notice the following points
When using the **WAGO-I/O SYSTEM 750** (electrical operation) with Ex approval, the following points are mandatory:

6.2.1 Special Conditions for Safe Operation of the ATEX and IEC Ex (acc. DEMKO 08 ATEX 142851X and IECEx PTB 07.0064)

The fieldbus-independent I/O modules of the WAGO-I/O-SYSTEM 750-.../...-... must be installed in an environment with degree of pollution 2 or better. In the final application, the I/O modules must be mounted in an enclosure with IP 54 degree of protection at a minimum with the following exceptions:

- I/O modules 750-440, 750-609 and 750-611 must be installed in an IP 64 minimum enclosure.
- I/O module 750-540 must be installed in an IP 64 minimum enclosure for 230 V AC applications.
- I/O module 750-440 may be used up to max. 120 V AC.

When used in the presence of combustible dust, all devices and the enclosure shall be fully tested and assessed in compliance with the requirements of IEC 61241-0:2004 and IEC 61241-1:2004.

When used in mining applications the equipment shall be installed in a suitable enclosure according to EN 60079-0:2006 and EN 60079-1:2007.

I/O modules fieldbus plugs or fuses may only be installed, added, removed or replaced when the system and field supply is switched off or the area exhibits no explosive atmosphere.

DIP switches, coding switches and potentiometers that are connected to the I/O module may only be operated if an explosive atmosphere can be ruled out.

I/O module 750-642 may only be used in conjunction with antenna 758-910 with a max. cable length of 2.5 m.

To exceed the rated voltage no more than 40%, the supply connections must have transient protection.

The permissible ambient temperature range is 0 °C to +55 °C.

6.2.2 Special conditions for safe use (ATEX Certificate TÜV 07 ATEX 554086 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the field bus independent I/O modules WAGO-I/O-SYSTEM 750-*** shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) EN 60079-0, EN 60079-11, EN 60079-15, EN 61241-0 and EN 61241-1. For use as group I, electrical apparatus M2, the apparatus shall be erected in an enclosure that ensures a sufficient protection according to EN 60079-0 and EN 60079-1 and the degree of protection IP64. The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExNB.

2. If the interface circuits are operated without the field bus coupler station type 750-3../…-… (DEMKO 08 ATEX 142851 X), measures must be taken outside of the device so that the rating voltage is not being exceeded of more than 40% because of transient disturbances.

3. DIP-switches, binary-switches and potentiometers, connected to the module may only be actuated when explosive atmosphere can be excluded.

4. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded. This is although and in particular valid for the interfaces “CF-Card”, “USB”, “Fieldbus connection“, “Configuration and programming interface“, “antenna socket“, “D-Sub“ and the “Ethernet interface“. These interfaces are not energy limited or intrinsically safe circuits. An operating of those circuits is in the behalf of the operator.

5. For the types 750-606, 750-625/000-001, 750-487/003-000, 750-484 and 750-633 the following shall be considered: The interface circuits shall be limited to overvoltage category I/II/III (non mains/mains circuits) as defined in EN 60664-1.

6. For the type 750-601 the following shall be considered: Do not remove or replace the fuse when the apparatus is energized.

7. The ambient temperature range is: 0°C ≤ T_a ≤ +55°C (for extended details please note certificate).

8. The following warnings shall be placed nearby the unit:

⚠ **WARNING**

Do not remove or replace fuse when energized!
If the module is energized do not remove or replace the fuse.

⚠ **WARNING**

Do not separate when energized!
Do not separate the module when energized!

⚠ **WARNING**

Separate only in a non-hazardous area!
Separate the module only in a non-hazardous area!

6.2.3 Special conditions for safe use (IEC-Ex Certificate TUN 09.0001 X)

1. For use as Dc- or Gc-apparatus (in zone 2 or 22) the fieldbus independent I/O modules WAGO-I/O-SYSTEM 750-*** shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) IEC 60079-0, IEC 60079-11, IEC 60079-15, IEC 61241-0 and IEC 61241-1. For use as group I, electrical apparatus M2, the apparatus shall be erected in an enclosure that ensures a sufficient protection according to IEC 60079-0 and IEC 60079-1 and the degree of protection IP64. The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExCB.

2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40% because of transient disturbances.

3. DIP-switches, binary-switches and potentiometers, connected to the module may only be actuated when explosive atmosphere can be excluded.

4. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded. This is although and in particular valid for the interfaces “CF-Card”, “USB”, “Fieldbus connection“, “Configuration and programming interface“, “antenna socket“, “D-Sub“ and the “Ethernet interface“. These interfaces are not energy limited or intrinsically safe circuits. An operating of those circuits is in the behalf of the operator.

5. For the types 750-606, 750-625/000-001, 750-487/003-000, 750-484 and 750-633 the following shall be considered: The interface circuits shall be limited to overvoltage category I/II/III (non mains/mains circuits) as defined in IEC 60664-1.

6. For the type 750-601 the following shall be considered: Do not remove or replace the fuse when the apparatus is energized.

7. The ambient temperature range is: $0°C \leq T_a \leq +55°C$ (For extensions please see the certificate).

8. The following warnings shall be placed nearby the unit:

⚠ **WARNING**

Do not remove or replace fuse when energized!
If the module is energized do not remove or replace the fuse.

⚠ **WARNING**

Do not separate when energized!
Do not separate the module when energized!

⚠ **WARNING**

Separate only in a non-hazardous area!
Separate the module only in a non-hazardous area!

6.2.4 ANSI/ISA 12.12.01

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only.

This equipment is to be fitted within tool-secured enclosures only.

⚠ WARNING

Explosion hazard!
Explosion hazard - substitution of components may impair suitability for Class I, Div. 2.

⚠ WARNING

Disconnect device when power is off and only in a non-hazardous area!
Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous near each operator accessible connector and fuse holder." When a fuse is provided, the following information shall be provided: “A switch suitable for the location where the equipment is installed shall be provided to remove the power from the fuse.”

For devices with Ethernet connectors:
”Only for use in LAN, not for connection to telecommunication circuits”.

⚠ WARNING

Use only with antenna module 758-910!
Use Module 750-642 only with antenna module 758-910.

For Couplers/Controllers and Economy bus modules only: "The configuration Interface Service connector is for temporary connection only. Do not connect or disconnect unless the area is known to be nonhazardous. Connection or disconnection in an explosive atmosphere could result in an explosion.

⚠ WARNING

Devices containing fuses must not be fitted into circuits subject to over loads!
Devices containing fuses must not be fitted into circuits subject to over loads, e.g. motor circuits!

⚠ WARNING

Do not connect or disconnect SD-Card unless the area known to be free of ignitable concentrations of flammable gases or vapors!
Do not connect or disconnect SD-Card while circuit is live unless the area is known to be free of ignitable concentrations of flammable gases or vapors.

Information

Additional Information
Proof of certification is available on request. Also take note of the information given on the module technical information sheet. The Instruction Manual, containing these special conditions for safe use, must be readily available to the user.

7 Appendix

7.1 MIB-II Groups

7.1.1 System Group

The system group contains general information about the coupler/controller

Identifier	Entry	Ac-cess	Description
1.3.6.1.2.1.1.1	sysDescr	R	This entry contains the device identifica-tion. The object has a fixed code (e.g., "WAGO 750-870").
1.3.6.1.2.1.1.2	sysObjectID	R	This entry contains the manufacturer's au-tho-rization identification.
1.3.6.1.2.1.1.3	sysUpTime	R	This entry contains the time (in hundredths of a second) since the management unit has been last reset.
1.3.6.1.2.1.1.4	sysContakt	R/W	This entry contains the identification and contact information for the system contact person.
1.3.6.1.2.1.1.5	sysName	R/W	This entry contains the administration-assigned device name.
1.3.6.1.2.1.1.6	sysLocation	R/W	This entry contains the node's physical loca-tion.
1.3.6.1.2.1.1.7	sysServices	R	This entry designates the quantity of ser-vices that this coupler/controller contains.

7.1.2 Interface Group

The interface group contains information and statistics about the device inter-face.

Identifier	Entry	Ac-cess	Description
1.3.6.1.2.1.2.1	ifNumber	R	Number of network interfaces in this sys-tem
1.3.6.1.2.1.2.2	ifTable	-	List of network interfaces
1.3.6.1.2.1.2.2.1	ifEntry	-	Network interface entry
1.3.6.1.2.1.2.2.1.1	ifIndex	R	This entry contains a unique value for each interface
1.3.6.1.2.1.2.2.1.2	ifDescr	R	This entry contains the name of the manu-facturer, the product name, and the version of the hardware interface: e.g., "WAGO Kontakttechnik GmbH 750-870: Rev 1.0".

Identifier	Entry	Ac-cess	Description
1.3.6.1.2.1.2.2.1.3	ifType	R	This entry describes the type of interface: Ethernet CSMA/CD = 6 Software Loopback = 24
1.3.6.1.2.1.2.2.1.4	ifMtu	R	This entry specifies the largest transfer unit; i.e., the maximum telegram length that can be transferred via this interface.
1.3.6.1.2.1.2.2.1.5	ifSpeed	R	This entry indicates the interface speed in bits per second.
1.3.6.1.2.1.2.2.1.6	ifPhysAddress	R	This entry indicates the physical address of the interface. For example, for Ethernet, this entry contains a MAC ID.
1.3.6.1.2.1.2.2.1.7	ifAdminStatus	R/W	This entry specifies the desired state of the interfaces. Possible values here are: up(1): ready for operation for transmission and reception down(2): interface is switched off testing(3): interface is in test mode
1.3.6.1.2.1.2.2.1.8	ifOperStatus	R	This entry indicates the current operational state of the interface.
1.3.6.1.2.1.2.2.1.9	ifLastChange	R	This entry indicates the value of the sysUp-Time when the state was last changed.
1.3.6.1.2.1.2.2.1.10	ifInOctets	R	This entry indicates the value of the sysUp-Time when the state was last changed.
1.3.6.1.2.1.2.2.1.11	ifInUcastPkts	R	This entry indicates the number of received unicast packets delivered to a higher layer.
1.3.6.1.2.1.2.2.1.12	ifInNUcastPkts	R	This entry indicates the number of received broad and multicast packets delivered to a higher layer.
1.3.6.1.2.1.2.2.1.13	ifInDiscards	R	This entry indicates the number of packets that were discarded even though no errors had been detected.
1.3.6.1.2.1.2.2.1.14	ifInErrors	R	This entry indicates the number of received packets that contained errors preventing them from being deliverable to a higher layer.
1.3.6.1.2.1.2.2.1.15	ifInUnknownProtos	R	This entry indicates the number of received packets sent to an unknown or unsupported port number.
1.3.6.1.2.1.2.2.1.16	ifOutOctets	R	This entry gives the total number of bytes sent via interface.
1.3.6.1.2.1.2.2.1.17	ifOutUcastPkts	R	This entry contains the number of outgoing unicast packets delivered to a higher layer.
1.3.6.1.2.1.2.2.1.18	ifOutNUcastPkts	R	This entry indicates the number of outgoing broad and multicast packets delivered to a higher layer.

Identifier	Entry	Ac-cess	Description
1.3.6.1.2.1.2.2.1.19	ifOutDiscards	R	This entry indicates the number of packets that were discarded even though no errors had been detected.
1.3.6.1.2.1.2.2.1.20	ifOutErrors	R	This entry indicates the number of packets that could not be transmitted because of errors.

7.1.3 IP Group

The IP group contains information about IP communication.

Identifier	Entry	Ac-cess	Description
1.3.6.1.2.1.4.1	ipForwarding	R/W	1: Host is a router; 2: Host is not a router
1.3.6.1.2.1.4.2	ipDefaultTTL	R/W	Default value for the Time-To-Live field of each IP frame
1.3.6.1.2.1.4.3	ipInReceives	R	Number of received IP frames, including those received in error
1.3.6.1.2.1.4.4	ipInHdrErrors	R	Number of received IP frames with header errors
.3.6.1.2.1.4.5	ipInAddrErrors	R	Number of received IP frames with a misdi-rected IP address
1.3.6.1.2.1.4.6	ipForwDatagrams	R	Number of received IP frames passed on (routed)
1.3.6.1.2.1.4.7	ipUnknownProtos	R	Number of received IP frames with an un-known protocol type
1.3.6.1.2.1.4.8	ipInDiscards	R	Number of received IP frames rejected although no disturbance was present
1.3.6.1.2.1.4.9	ipInDelivers	R	Number of received IP frames passed on a higher protocol layer
1.3.6.1.2.1.4.10	ipOutRequests	R	Number of sent IP frames
1.3.6.1.2.1.4.11	ipOutDiscards	R	Number of rejected IP Frames that should have been sent
1.3.6.1.2.1.4.12	ipOutNoRoutes	R	Number of sent IP frames rejected because of incorrect routing information
1.3.6.1.2.1.4.13	ipReasmTimeout	R	Minimum time duration until an IP frame is re-assembled
1.3.6.1.2.1.4.14	ipReasmReqds	R	Minimum number of the IP fragments for building up and passing on
1.3.6.1.2.1.4.15	ipReasmOKs	R	Number of IP frames re-assembled suc-cess-fully

Identifier	Entry	Access	Description
1.3.6.1.2.1.4.16	ipReasmFails	R	Number of IP frames not re-assembled successfully
1.3.6.1.2.1.4.17	ipFragOKs	R	Number of IP frames fragmented and passed on
1.3.6.1.2.1.4.18	ipFragFails	R	Number of IP frames that should have been fragmented but could not be, because their don't fragment bit was set in the header.
1.3.6.1.2.1.4.19	ipFragCreates	R	Number of generated IP fragment frames
1.3.6.1.2.1.4.20	ipAddrTable	-	Table of all local IP addresses of the coupler/controller
1.3.6.1.2.1.4.20.1	ipAddrEntry	-	Address information for an entry
1.3.6.1.2.1.4.20.1.1	ipAdEntAddr	R	The IP address corresponding to the entry's address information
1.3.6.1.2.1.4.20.1.2	ipAdEntIfIndex	R	Index of the interface
1.3.6.1.2.1.4.20.1.3	ipAdEntNetMask	R	The entry's associated subnet mask
1.3.6.1.2.1.4.20.1.4	ipAdEntBcastAddr	R	Value of the last significant bit in the IP broadcast address
1.3.6.1.2.1.4.20.1.5	ipAdEntReasm MaxSize	R	The size of the longest IP telegram that can be defragmented (reassembled) again.
1.3.6.1.2.1.4.23	ipRoutingDiscards	R	Number of deleted routing entries

7.1.4 IpRoute table

The IP route table contains information about the routing table in the coupler/controller.

Identifier	Entry	Access	Description
1.3.6.1.2.1.4.21	ipRouteTable	-	IP routing table
1.3.6.1.2.1.4.21.1	ipRouteEntry	-	A routing entry for a particular destination
1.3.6.1.2.1.4.21.1.1	ipRouteDest	R/W	This entry indicates the destination address of the routing entry.
1.3.6.1.2.1.4.21.1.2	ipRouteIfIndex	R/W	This entry indicates the index of the interface, which is the next route destination.
1.3.6.1.2.1.4.21.1.3	ipRouteMetric1	R/W	The primary route to the target system
1.3.6.1.2.1.4.21.1.4	ipRouteMetric2	R/W	An alternative route to the target system
1.3.6.1.2.1.4.21.1.5	ipRouteMetric3	R/W	An alternative route to the target system
1.3.6.1.2.1.4.21.1.6	ipRouteMetric4	R/W	An alternative route to the target system
.3.6.1.2.1.4.21.1.7	ipRouteNextHop	R/W	The IP address of the next route section
1.3.6.1.2.1.4.21.1.8	ipRouteType	R/W	The route type
1.3.6.1.2.1.4.21.1.9	ipRouteProto	R	Routing mechanism via which the route is developed

Identifier	Entry	Ac-cess	Description
1.3.6.1.2.1.4.21.1.10	ipRouteAge	R/W	Number of seconds since then the route was last renewed/examined
1.3.6.1.2.1.4.21.1.11	ipRouteMask	R/W	This entry contents the subnet mask for this entry
1.3.6.1.2.1.4.21.1.12	ipRouteMetric5	R/W	An alternative route to the target system
1.3.6.1.2.1.4.21.1.13	ipRouteInfo	R/W	A reference to a special MIB

7.1.5 ICMP Group

Identifier	Entry	Ac-cess	Description
1.3.6.1.2.1.5.1	icmpInMsgs	R	Number of received ICMP messages
1.3.6.1.2.1.5.2	icmpInErrors	R	Number of received ICMP errors containing ICMP-specific errors
1.3.6.1.2.1.5.3	icmpInDestUnreachs	R	Number of received ICMP destination unreachable messages
1.3.6.1.2.1.5.4	icmpInTimeExcds	R	Number of received ICMP time exceeded messages
1.3.6.1.2.1.5.5	icmpInParmProbs	R	Number of received ICMP parameter problem messages
1.3.6.1.2.1.5.6	icmpInSrcQuenchs	R	Number of received ICMP source quench messages
1.3.6.1.2.1.5.7	icmpInRedirects	R	Number of received ICMP redirect messages
1.3.6.1.2.1.5.8	icmpInEchos	R	Number of received ICMP echo request messages (Ping)
1.3.6.1.2.1.5.9	icmpInEchoReps	R	Number of received ICMP echo reply messages (Ping)
1.3.6.1.2.1.5.10	icmpInTimestamps	R	Number of received ICMP timestamp request messages
1.3.6.1.2.1.5.11	icmpInTimestamp Reps	R	Number of received ICMP timestamp reply messages
1.3.6.1.2.1.5.12	icmpInAddrMasks	R	Number of received ICMP address mask request messages
1.3.6.1.2.1.5.13	icmpInAddrMask Reps	R	Number of received ICMP address mask reply messages
1.3.6.1.2.1.5.14	icmpOutMsgs	R	Number of sent ICMP messages
1.3.6.1.2.1.5.15	icmpOutErrors	R	Number of sent ICMP messages that could not be sent due to errors
1.3.6.1.2.1.5.16	icmpOutDestUnreachs	R	Number of sent ICMP destination unreachable messages
1.3.6.1.2.1.5.17	icmpOutTimeExcds	R	Number of sent ICMP time exceeded messages
1.3.6.1.2.1.5.18	icmpOutParmProbs	R	Number of sent ICMP parameter problem messages
1.3.6.1.2.1.5.19	icmpOutSrcQuenchs	R	Number of sent ICMP source quench messages
1.3.6.1.2.1.5.20	icmpOutRedirects	R	Number of sent ICMP redirection messages
1.3.6.1.2.1.5.21	icmpOutEchos	R	Number of sent ICMP echo request messages
1.3.6.1.2.1.5.22	icmpOutEchoReps	R	Number of sent ICMP echo reply messages
1.3.6.1.2.1.5.23	icmpOutTimestamps	R	Number of sent ICMP timestamp request

Identifier	Entry	Ac-cess	Description
			messages
1.3.6.1.2.1.5.24	icmpOutTimestam-pReps	R	Number of sent ICMP timestamp reply messages
1.3.6.1.2.1.5.25	icmpOutAddrMasks	R	Number of sent ICMP address mask request messages
1.3.6.1.2.1.5.26	icmpOutAddrMask Reps	R	Number of sent ICMP address mask reply messages

7.1.6 TCP Group

Identifier	Entry	Ac-cess	Description
1.3.6.1.2.1.6.1	tcpRtoAlgorithm	R	Retransmission time 1 = other, 2 = constant, 3 = MIL-standard 1778, 4 = Jacobson
1.3.6.1.2.1.6.2	tcpRtoMin	R	Minimum value for the retransmission timer
1.3.6.1.2.1.6.3	tcpRtoMax	R	Maximum value for the retransmission timer
1.3.6.1.2.1.6.4	tcpMaxConn	R	Number of maximum TCP connections that can exist simultaneously
1.3.6.1.2.1.6.5	tcpActiveOpens	R	Number of existing active TCP connections
1.3.6.1.2.1.6.6	tcpPassiveOpens	R	Number of existing passive TCP connecti-ons
1.3.6.1.2.1.6.7	tcpAttemptFails	R	Number of failed connection attempts
1.3.6.1.2.1.6.8	tcpEstabResets	R	Number of connection resets
1.3.6.1.2.1.6.9	tcpCurrEstab	R	The number of TCP connections for which the current state is either Established or Close-Wait
1.3.6.1.2.1.6.10	tcpInSegs	R	Number of received TCP frames including the error frames
1.3.6.1.2.1.6.11	tcpOutSegs	R	Number of correctly sent TCP frames with data
1.3.6.1.2.1.6.12	tcpRetransSegs	R	Number of sent TCP frames retransmitted because of errors
1.3.6.1.2.1.6.13	tcpConnTable	-	For each existing connection, a table entry is created
1.3.6.1.2.1.6.13.1	tcpConnEntry	-	Table entry for connection
1.3.6.1.2.1.6.13.1.1	tcpConnState	R	This entry indicates the status of the TCP connection

Identifier	Entry	Access	Description
1.3.6.1.2.1.6.13.1.2	tcpConnLocal Address	R	The entry contains the IP address for the connection. For a server, this entry is constant 0.0.0.0
1.3.6.1.2.1.6.13.1.3	tcpConnLocal Port	R	The entry indicates the port number of the TCP connection.
1.3.6.1.2.1.6.13.1.4	tcpConnRem Address	R	The entry contains the remote IP address of the TCP connection.
1.3.6.1.2.1.6.13.1.5	tcpConnRemPort	R	The entry contains the remote port of the TCP connection.
1.3.6.1.2.1.6.14	tcpInErrs	R	Number of received incorrect TCP frames
1.3.6.1.2.1.6.15	tcpOutRsts	R	Number of sent TCP frames with set RST flag

7.1.7 UDP Group

Identifier	Entry	Access	Description
1.3.6.1.2.1.7.1	udpInDatagrams	R	Number of received UDP frames that **could be passed** on to the appropriate applications
1.3.6.1.2.1.7.2	udpNoPorts	R	Number of received UDP frames that **could not be** passed on to the appropriate applications (port unreachable)
1.3.6.1.2.1.7.3	udpInErrors	R	Number of received UDP frames that **could not be** passed on to the appropriate applications for other reasons.
1.3.6.1.2.1.7.4	udpOutDatagrams	R	Number of sent UDP frames
1.3.6.1.2.1.7.5	udpTable	-	A table entry is created for each application that received UDP frames
1.3.6.1.2.1.7.5.1	udpEntry	-	Table entry for an application that received an UDP frame
1.3.6.1.2.1.7.5.1.1	udpLocalAddress	R	IP address of the local UDP server
1.3.6.1.2.1.7.5.1.2	udpLocalPort	R	Port number of the local UDP server

7.1.8 SNMP Group

Identifier	Entry	Access	Description
1.3.6.1.2.1.11.1	snmpInPkts	R	Number of received SNMP frames
1.3.6.1.2.1.11.2	snmpOutPkts	R	Number of sent SNMP frames
1.3.6.1.2.1.11.3	snmpInBadVersions	R	Number of received SNMP frames with an invalid version number
1.3.6.1.2.1.11.4	snmpInBadCommunityNames	R	Number of received SNMP frames with an invalid community
1.3.6.1.2.1.11.5	snmpInBadCommunityUses	R	Number of received SNMP frames whose community did not have sufficient authorization for the actions that it tried to execute
1.3.6.1.2.1.11.6	snmpInASNParse Errs	R	Number of received SNMP frames with an incorrect structure
1.3.6.1.2.1.11.8	snmpInTooBigs	R	Number of received SNMP frames that acknowledged the result too Big
1.3.6.1.2.1.11.9	snmpInNoSuch Names	R	Number of received SNMP frames that acknowledged the result noSuchName
1.3.6.1.2.1.11.10	snmpInBadValues	R	Number of received SNMP frames that acknowledged the result bad value
1.3.6.1.2.1.11.11	snmpInReadOnlys	R	Number of received SNMP frames that acknowledged the result readOnly
1.3.6.1.2.1.11.12	snmpInGenErrs	R	Number of received SNMP frames that acknowledged the result genError
1.3.6.1.2.1.11.13	snmpInTotalReq Vars	R	Number of received SNMP frames with valid GET or GET-NEXT requests
1.3.6.1.2.1.11.14	snmpInTotalSet Vars	R	Number of received SNMP frames with valid SET requests
1.3.6.1.2.1.11.15	snmpInGetRequests	R	Number of GET requests received and processed
1.3.6.1.2.1.11.16	snmpInGetNexts	R	Number of GET-NEXT requests received and processed

Identifier	Entry	Access	Description
1.3.6.1.2.1.11.17	snmpInSetRequests	R	Number of SET requests received and processed
1.3.6.1.2.1.11.18	snmpInGet Responses	R	Number of received GET responses
1.3.6.1.2.1.11.19	snmpInTraps	R	Number of received traps
1.3.6.1.2.1.11.20	snmpOutTooBigs	R	Number of sent SNMP frames that contained the result too Big
1.3.6.1.2.1.11.21	snmpOutNoSuch Names	R	Number of sent SNMP frames that contained the result noSuchName
1.3.6.1.2.1.11.22	snmpOutBadValues	R	Number of sent SNMP frames that contained the result bad value
1.3.6.1.2.1.11.24	SnmpOutGenErrs	R	Number of sent SNMP frames that contained the result genErrs
1.3.6.1.2.1.11.25	snmpOutGet Requests	R	Number of GET requests sent
1.3.6.1.2.1.11.26	SnmpOutGetNexts	R	Number of GET NEXT requests sent
1.3.6.1.2.1.11.27	snmpOutSet Requests	R	Number of SET requests sent
1.3.6.1.2.1.11.28	snmpOutGet Responses	R	Number of GET responses sent
1.3.6.1.2.1.11.29	snmpOutTraps	R	Number of traps sent
1.3.6.1.2.1.11.30	snmpEnable AuthenTraps	R/W	Authentification failure traps 1 = on, 2 = off

8 List of Literature

Further Information
The PNO provides further documentation for its members on internet.

http://www.profibus.com/

9 Index

INNOVATIVE CONNECTIONS

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